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This is a monthly publication presenting brief articles concerning recent developments in European scientific research. It is hoped that these articles (which do not constitute part of the scientific literature) may prove of value to American scientists by disclosing interesting information well in advance of the usual scientific publications.

The articles are written by members of the scientific staff of ONRL, with an occasional article contributed by a visiting stateside scientist.

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Edited by Seymour L. Hess and Victoria S. Hewitson

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E.I. SALKOVITZ
Scientific Director

A.J. VAN TUYL, Jr.
Captain USN
Commanding Officer

AEROSPACE

EUROPEAN AEROSPACE COOPERATION

Closer cooperation between British and European aerospace companies is a subject which has been receiving increased attention in the news media lately. One of the truths which has become increasingly clear to me since my arrival here is that the Europeans intend to free themselves from a substantial reliance on American aerospace hardware by creating a vibrant and competitive aerospace industry of their own. Certainly they possess the technological expertise and the necessary financial where-with-all to make it happen. Evidence of their intent lies in the fact that the major West European aerospace companies are presently discussing plans to merge into two large groups capable of effectively competing with the US and Soviet aerospace giants.

According to Ludwig Boelkow, Chairman of Messerschmitt-Boelkow-Blohm (MBB), West Germany's largest aerospace company, closer collaboration of European industry in all major aerospace and high technology projects is not only feasible but mandatory from a management, engineering and economic viewpoint. These same views are held by Allen Greenwood, Deputy Managing Director of British Aircraft Corporation (BAC), who believes that British, French, German and Italian aerospace companies may be merged into two large corporations by the year 1980. In a joint interview, both of these executives, stressed that the various governments involved are "more or less" backing plans for closer collaboration.

It is interesting to note that all current candidates for mergers are already collaborating in major projects, the most familiar being the much-publicized and much-debated Concorde Mach-2 aircraft under joint development and construction by BAC and France's Aerospatiale. Another major collaborative effort is the medium-range 250-seat A300B European airbus under construction at the Aerospatiale facilities in Toulouse, France. On this project, MBB, VFW-Fokker, Aerospatiale, and the Spanish state-owned firm of Casa are working together, with the British firm of Hawker-Siddeley being an important subcontractor. Actually, Hawker-Siddeley builds the wings which are then flown by a super-guppy aircraft to Toulouse where they are mated to the A300B fuselage. Also prominent in the news is the MRCA (multiple-role combat aircraft) project being undertaken by BAC, MBB, and Fiat. Rounding out the list of projects, we have Dassault-Brequet and BAC as equal partners in building the Jaguar interceptor for Britain and France; Fiat, Dassault-Brequet, and Casa jointly building the Mercure, a 150-seat medium-range two-engine jet liner; BAC, MBB, and Saab-Scania of Sweden agreeing to pool their research and development technology in the field of STOL (short take-off and landing) aircraft. Although Rolls-Royce and Snecma of France are not, to this author's knowledge, presently jointly involved in a major aircraft engine project, the local press has been full of speculations to the effect that they, too, will soon unite in such an effort. For further information with regard to the possible emergence of a European engine consortium, see the February 7th (1972) issue of <u>Aviation Week and Space Technology</u>.

In the interview, both company officials rejected the idea that these existing European firms should be merged into one corporate giant. Greenwood was quoted as saying that, "if we formed two units, each would be strong enough on its own to compete with US corporations." He went on to add that, "what's more, we need two units to remain competitive." Furthermore, they explained that since much of what keeps industry busy both in civil and military sectors is based on government contracts and subsidies, it is only logical for the industry to offer governments the choice between two European manufacturers rather than one giant organization and other non-European companies.

Neither Boelkow nor Greenwood would commit himself as to which companies were likely to join together. However, one of the grand schemes under discussion is a link-up of BAC-Aerospatiale-MBB-Aeritalia (a joint Fiat-Alfa Romeo unit) and a merger of Hawker-Siddeley with VFW-Fokker and Dassault-Brequet. Boelkow did confide that, "a variety of studies and calculations in this direction have been made by the individual companies involved and are being discussed now."

Clearly, the mood in Europe at this point in time is to cooperate and collaborate in economic ventures on an ever increasing scale. As Great Britain moves closer to full-fledged

membership in the EEC (European Economic Community), the probability that her aerospace companies may merge with some of those on the Continent steadily increases. The advent of mergers such as these is certain to increase the world-wide competition in the already highly-competitive aerospace industry. (A.A Ranger)

BIOLOGICAL SCIENCES

INTERNATIONAL SYMPOSIUM ON VENTILATORY AND PHONATORY CONTROL SYSTEMS

This Symposium, held on 24-28 Jan 1972 at the Royal College of Surgeons of England in London, was organized by Dr. W.J. Gould, Head of the Department of Otolaryngology of Lenox Hill Hospital, New York, and Dr. B.D. Wyke, Head of the Neurological Laboratory at the Royal College of Surgeons (see ESN 25-12; 374).

Respiratory physiologists and neurophysiologists, on the one hand, and phoneticians, on the other, have worked in parallel, but generally quite independently, on quite intimately related aspects of the same basic mechanism - the control of the respiratory apparatus. The one group has been concerned primarily with ventilation - the mechanical aspects of control of chest movement and the flow of the respiratory gases. The other has been concerned with the control and modification of air movement in the production of speech. The purposes of the Symposium were to bring together investigators in these areas to acquaint each other with basic aspects of and current research in the respective fields, to implement common understanding of current problems, and, hopefully, to stimulate further research on problems common to the two groups.

About forty people were invited to the Symposium, these generally among the outstanding workers in the field. The program was exceptionally well planned. Only twenty-four 30-minute papers were given over the five days, each paper (or in some cases a pair) being followed by 30 minutes of discussion. The small size of the participating group and the generous allotment of time made for exceptionally fruitful discussion.

The main topics and speakers were: I. Basic Principles of Ventilatory and Phonatory Behaviour - E.J.M. Campbell (Hamilton, Ontario), B. Bishop (Buffalo), J. Mead and J.C. Bunn (Harvard), D.F. Proctor (Baltimore), G.A. Cavagna (Milan); II. Mechanisms Influencing Ventilatory Behaviour - C. von Euler (Stockholm), A.A. Viljanen (Helsinki), J.G. Widdicombe (Oxford), S. Freedman (London), S. Godfrey (London), M.I. Cohen (New York), F. Plum (New York); III. Physical Aspects of Ventilatory and Phonatory Behaviour - B. Emery et al (Glasgow), F. Winckel (Berlin), J.E. Malcolm (Cambridge, England); IV. Mechanisms Influencing Phonatory Behaviour - D.H. Klatt and K.N. Stevens (Cambridge, Mass.), P. Ladefoged (Los Angeles), A.J. Fourcin (London), A.B. Otis (Gainesville, Fla.), W.J. Gould and H. Okamura (New York); and a final session on anatomy and reflexology of the laryngeal muscles - R. Bowden (London), A. Mårtensson et al (Stockholm), B.D. Wyke (London), J.A. Kirchner and Y. Murakami (New Haven).

The participants were guests of the Royal College of Surgeons for an enjoyable reception on one evening and an elegant dinner on another. The remarkable collection of the Hunterian Museum and some of the treasures of the College's library were displayed on these evenings. On another day the entire group were taken by bus to Oxford in the afternoon for a tour of some of the colleges and dinner at New College. All together, this was a most rewarding meeting, both scientifically and socially.

The proceedings of the Symposium are to be published by Oxford University Press. I was told by Dr. J.C. Gregory, Medical Editor for the Press, that if authors cooperate, the volume should appear in six months. If so, this is much better than par for such symposium publications. (R.R. Sonnenschein)

THE PHYSIOLOGICAL FLOW STUDIES UNIT AT IMPERIAL COLLEGE

Since 1966 when it was established, this Unit, unique in Britain, has operated within the Department of Aeronautics at Imperial College. Its aim is to foster fundamental research on problems of flow of body fluids, chiefly blood and respiratory gas, through collaboration of physiologists, physical scientists, mathematicians and engineers.

On a visit to the new and quite attractive buildings of Imperial College in London's Kensington area, I was told by Dr. C.B. Caro, Director of the Unit, of some of the recent and current re-

search projects carried out by the group of some half dozen scientists. They have found that flow of blood or gas in large arteries (including the aorta) and bronchi, respectively, is associated with high Reynolds numbers, of the order of 100-1000, so that the linear Poiseuille relation of pressure to flow is not applicable. Instead, the influences of shears and alterations in flow patterns associated with branching of vessels must be critically examined.

Among interesting and important findings derived from such analysis are those recently reported by Caro and his associates on the relation between development of atheroma and arterial wall shear (Proc. Roy. Soc., London B, 177, 109-159 (1971)). Contrary to what had been earlier postulated, they found that the development of early atheroma in man is associated with those regions of arteries and their branches where wall shear rate is relatively low, and is inhibited where the shear rate is high. This is inconsistent with the view that atheroma is associated with damage of the vessel wall resulting from motion of the blood. Instead, Caro proposes that shear enhances mass transport of substances between blood and vessel wall, through steepening of the concentration gradient, and that the reduced diffusion (perhaps of cholesterol), in those areas of low shear predisposes to development of atheroma.

In addition to such clinical-physiological investigations, the group have developed instruments for investigating pressure-flow relations. An example is a direction-sensitive hot-film anemometer probe for measuring flow velocities in blood vessels (see Journal of Physics E: Scientific Instruments 3, 377-384 (1970)).

This type of interdisciplinary group, similar in composition and aims to Zweifach's bioengineering group at University of California, San Diego, offers the only promising approach to this area of physiology which depends so essentially on applied mathematics and engineering. (R.R. Sonnenschein)

ONE-MAN POWERHOUSE OF MOLECULAR BIOLOGY!

Motor-driven models of DNA were one of the more obvious attractions on my recent visit to the Department of Postgraduate Molecular Biology at the North East London Polytechnic. But, as I soon learned, the real attraction of the Department is Dr. S. Lewin, who is a one-man powerhouse full of fascinating, unusual explanations of many biochemically important reaction mechanisms. These include, for example, mechanisms for messenger-RNA synthesis and for protein stabilization which, if correct, should be of great value in understanding these and related biochemical phenomena.

At present Lewin is the head and sole permanent member of his Department. Offhand, it might seem Parkinson's laws were not operative since Lewin formerly headed (in the same building) the rather large Science Department at what was then called the South West Essex Technical College and later the Waltham Forest Technical College. But during the final reshuffle when the North East London Polytechnic was established by joining (on paper) three technical colleges in the area, new chairmen of chemistry, physics, biology, etc., were chosen to direct operations at all three locations -- at best an awkward administrative arrangement and part of the reason for hiring additional staff and thereby validating Parkinson! Since biochemistry had been split between biology and chemistry and since Lewin was also directing one of the largest research groups at the Polytechnic, he was given the new Postgraduate Department of Molecular Biology. Lewin admitted he was a bit miffed at first about losing the chairmanship of a department with some twenty people which he had helped to build. But he soon realized that his loss of administrative duties was no loss at all since he was then freer to pursue his research and teaching interests. The latter include, among other things, the regular organization of short (four- or five-day) courses in specialized topics commonly given by outside lecturers. The most recent offerings in the Fall were "Advanced Cellular-Immunology Techniques," "Protein Fractionation" and "Advanced Physico-immunological Techniques." The courses have been very well received as judged by a typical enrollment of 30-40, with attendees coming from all parts of England and commonly even from the Continent.

Despite the small size of his research group, presently around six, and his comparative isolation at the Polytechnic from other scientists with similar interests, Lewin has done very well for himself. He has managed, for example, to acquire four or five generous-sized laboratories very well equipped with the usual biochemical instrumentation as well as some larger items like an analytical centrifuge, amino acid

analyzer, various spectrophotometers and spectropolarimeters. While these have all been recently used to profit in studying such subjects as the effects of deuterium oxide on melting curves of various polynucleotides, it seemed clear to me that his present love and interests center on building molecular models.

Outside his office, Lewin has a room full of large models of DNA, his office is strewn with various fragments of molecular models, he has large books of photographs of models, airliner bags full which he carries forth and back to work and, I noticed (when he drove me to the underground station), at least one large polypeptide chain in the trunk of his car! What does he do with these models? Basically, he studies them for hours on end in their various conformations to see if they can provide clues to explain some biochemical problem. (This may strike some of our readers as more of a game than a subject for serious study, but I found even a casual study of his DNA models very instructive. For example, the striking differences in the wide and narrow grooves of the polymer and the interesting details of the transition from a ladder to a helical structure can really only be fully appreciated in models made with space-filling atoms, e.g., the Courtalds type used by Lewin.) He mentioned a number of problems studied and clarified through studies of models, some of which have already been published. Others are contained in a book Displacement of Water in Biological Reactions which is to be published by Academic Press in the Fall or in Nucleic Acid Structure and Function Potential which is the tentative title for a book whose manuscript he hopes to complete in a year. Of the many problems he discussed, I will only describe two.

The first is concerned with the role of histones in messenger-RNA synthesis. While it has been known for many years that in the cell nucleus positively charged histone proteins are tightly bound to the negatively charged DNA, until recently it was assumed that the histone binding simply provided some mechanical rigidity for the DNA or perhaps protected it against the hydrolytic action of the nuclease enzymes. A corollary of this is that the sequence of amino acids in the histone should not be too critical. But the recently discovered extreme stability of certain histone sequences during evolution (which are virtually identical, for example, in species as far removed as the cow and the legume) suggests a more specialized function for them. Lewin suggests that the histone playes a role in determining the specificity of attaching new bases during messenger-RNA synthesis.

(For the general reader I will amplify this briefly. DNA is a polymer containing a series of monomer molecules, called bases, which are of four types: A, T, G, and C. A given linear sequence of these bases is ultimately used to determine the linear sequence of twenty different natural amino acids in a corresponding protein, and nature has evolved an elaborate way to effect this translation from a sequence of bases into a sequence of amino acids. Among other things, the translation requires that at an intermediate stage in protein synthesis an equivalent copy of the DNA sequence be made in another polynucleic acid which is called "messenger ribonucleic acid"or"m-RNA" for short. Obviously, in order to avoid errors in the protein sequence the m-RNA must have an accurate copy of the information in the DNA sequence. Since three bases are needed to code for each amino acid, and since a protein has typically one hundred amino acids, this requires an accurate reading, or "transcription" as it is called, of about 300 nucleotides in the DNA into 300 complementary nucleotides in m-RNA.)

In order to synthesize m-RNA, each of the DNA bases must eventually be "recognized" by a complementary base in the messenger. But the binding forces of the hydrogen bonds between the complementary bases are weak which suggests errors would occur on pairing. The bonding could be strengthened in the following way. From a careful study of models of DNA, RNA and histones, Lewin has concluded that three histone amino acids could complex through hydrogen and hydrophobic bonds to a particular triplet and in doing so assume a conformation which exposes complementary groups to a similar histone bound to the bases of the RNA. For example, if the DNA-bound histone amino acids are forced into a conformation exposing three hydrophoboic groups, then the RNA-bound histone amino acids on the three complementary bases will also expose three hydrophobic groups. Furthermore the geometry is such that if the hydrogen bonds of the complementary bases are then matched, the three pairs of hydrophobic groups of the histones will also be brought into contact thereby reenforcing the hydrogen bonding.and giving greater specificity to the match.

Lewin has now carefully studied models of the 54 possible combinations of base triplets and determined what histone sequences would best fit them. (These are tabulated in the J. Theor. Biol. 29, 1 (1970).)

The second problem which Lewin has studied, in part by model building, is the role of water in the pairing of polymer chains, e.g., the pairing of complementary DNA chains or the similar "internal pairing" which occurs when a random polypeptide forms a regular structure such as an alpha helix. From a thermodynamic point of view, the likelihood of pairing like this is not too favorable since the enthalpy of hydrogen bonding is small. Furthermore, there is a considerable loss in entropy associated with the chain pairing on helix formation. Yet, these structures are known to be quite stable. Why?

Lewin argues that groups which are capable of forming hydrogen bonds, e.g., an amide hydrogen to a carbonyl, are all hydrated before, but not after, hydrogen-bond formation. Thus, during the base pairing when two free DNA strands are brought together into a ladder, a total of four waters (two for each of the two hydrogen bonds formed) are "extruded" for each base pair formed and the increase in entropy helps drive the bond formation. Model building also shows that when the ladder is twisted into a helix still more water is extruded. Again, the entropy increase in going from bound to free water favors the helix. Similar arguments apply to helix formation, and model building shows that the reason alpha helices are favored over gamma-helix polypeptides is that more water is extruded during the formation of the former. Lewin makes no claim that his water extrusion idea is unique or that it will provide a panacea to explain all problems associated with structure of polyelectrolytes in aqueous solution. But he does feel that his emphasis on it is new, and he has used it as one basis for his forthcoming book Displacement of Water in Biological Reactions which was mentioned earlier.

Another current project of Lewin's is to develop a new master of science program in molecular biology which would prepare individuals for the rapid fusion he expects to take place between molecular biology and electronic instrumentation. As an example of such a fusion it seems fairly certain that within 10 years automatic polypeptide synthesizers with quite complex electronics will routinely produce all manner of polypeptide hormones and small enzymes. In order to keep such machines in running order and in order to know what improvements might be effected in the electronics, one would need to have someone with strong biochemical and electronic training and interests. Lewin is presently arranging a two- or three-week trip to the US around Easter to visit some people who have established similar programs. (John G. Foss)

EARTH SCIENCES

ATMOSPHERIC CHEMISTRY AT FRANKFURT AM MAIN

Atmospheric chemistry deals with man-made and natural pollutants in the atmosphere; their injection, chemical and physical modifications, transport, and deposition. This is recognized today as a clearly important subject but, fortunately, a handful of scientists around the world anticipated the current interest and devoted themselves to this subject 20 or more years ago, long before it was stylish. Their pioneering work in this difficult field established a base from which far more rapid progress can be made now than would have been possible without their foresight. One of these prescient men is Prof. Hans-Walter Georgii, director of the meteorology section of the Institut für Meteorologie und Geophysik, Johann Wolfgang Goethe-Universität, Frankfurt am Main. (For a description of the geophysics section see ESN 25-11; 351.)

The Institute has an interesting history. It was founded in 1906, eight years before the University was created and was incorporated into the new school at its founding. The director of the Institute from 1914-1944 was Prof. Linke, a name well known to those acquainted with the development of modern meteorology. Linke was killed during an air raid in 1944.

It is typical today in West Germany that relatively many university institutes are devoted to meteorology, each specializing in only a few branches of the subject, with a small faculty and having only some 20-30 students. This is not as inefficient as it may seem to Americans who are accustomed to larger departments, covering many areas, and having many students. The small distances separating cities in Central Europe permit easy intellectual inter-

change, and students select an institute at which to study by choosing the area in which they wish to specialize.

Meteorological research at this Institute is confined to atmospheric chemistry (conceived as a basic scientific endeavor), air pollution (applied science) and cloud physics. The latter is small and is declining. Atmospheric chemistry is supported by the German equivalent of our NSF and pollution by the federal Ministry of the Interior.

The work in chemistry is largely concerned with sulfur in the atmosphere, a central problem (c.f., Kellogg, et al., "The Sulfur Cycle," Science 175, 587-596, 1972.) Sulfur is produced largely as SO_2 and H_2S. A variety of reaction chains are known to oxidize these forms to sulfate which appears largely in particulate form, either in the lower troposphere or as a well-established layer of sulfate particles in the stratosphere at elevations of 16-18 km. At present, the chief uncertainties in our understanding of the sulfur cycle are the production rates, the oxidation rates, vertical and horizontal transports, and the deposition processes and rates. The magnitude of the problem is represented by the large rate of production (estimated to be about 380 million metric tons per year of SO_4 in the Northern Hemisphere, of which some 140 million tons is man made) and its influence, upon deposition, in acidifying lakes, rivers and non-alkaline soils. The latter effect has been documented in Sweden's case study for the UN Conference on the Human Environment (Air Pollution Across National Boundaries, The Impact on the Environment of Sulfur in Air and Precipitation. 1971, R. Ministry for Foreign Affairs and R. Ministry of Agriculture).

Since the end form of atmospheric sulfur is sulfate, the oxidation processes and their rates must be determined. There are several such processes and Georgii's group, which includes two American PhD's, is currently actively investigating a model which begins with the hydration of gaseous SO_2:

$$SO_2 + H_2O \rightleftharpoons SO_2 \cdot H_2O$$

This is followed by either or both of two reactions:

$$SO_2 \cdot H_2O \rightleftharpoons HSO_3^- + H^+$$

$$SO_2 \cdot H_2O + OH^- \rightleftharpoons HSO_3^- + H_2O$$

The hydroxyl required in the second reaction comes, presumably, from dissociation of water. This is followed by a dissociation:

$$HSO_3^- \rightleftharpoons SO_3^= + H^+$$

and then by an irreversible oxidation:

$$SO_3^= + \tfrac{1}{2}O_2 \rightarrow SO_4^=$$

The importance of this model depends upon the reaction coefficients and upon the concentrations of the various reactants. Georgii and his co-workers are busy measuring the rate coefficients in the laboratory. When this is done for all possible models, we will know how and at what rate sulfate is produced in the atmosphere.

Since atmospheric sulfur is also produced as H_2S, it is important to have a reliable and feasible means of measuring the small concentrations involved. Georgii's group is developing a new technique for this measurement with the aim of a detectibility limit of 1 $\mu g/m^3$ (less than 1 part per billion by mass at sea level). This is clearly difficult to do, but early results are encouraging and work continues.

In the pollution effort, Georgii and colleagues have set up a well-instrumented system for monitoring pollution in the valley of the Main River around Frankfurt. They have a total of eight stations, three of which are in the valley proper and measure CO_2, CO, SO_2, organics and nitrogen oxides. The other five are outlying and measure CO_2 only. All stations operate automatically, and data are transmitted to the Institute where they are recorded continuously on strip charts. The data are also automatically digitized, fed to a small computer and half-hourly averages are printed. The goal is to build up a climatology of pollution in the area and so provide a base from which improvements and deteriorations in the pollution situation can be determined. Monitoring of the environment is a popular activity these days but one in which it is really necessary to gain experience before proceeding to large and expensive networks. Thus, this local network is also a valuable pilot project. It seems to have attracted some degree of international notice since a number of foreign officials have come to see it. The day I visited the Institute a

The five or six faculty members I talked with were relatively young, especially for the academic rank they held. Each showed intense dedication to the concept of the Open University, and each was working at a very intense rate. Each had obtained his position in competition with nine or ten others. There is no question but that the financial remuneration and the faculty rank offered exceeds that of standard universities, but I suspect that these inducements were secondary to the commitment to more universal higher education. The on-campus faculty lives and works in a location removed from the UK cultural and educational centers. (Academics from the Universities do sometime participate in the TV presentations and, if time permits us, their role will be examined in a subsequent article.) They have no time to pursue the traditional research interests developed during their own graduate studies. They have duties for coordinating with publication and TV-radio specialists unknown to the usual academic. They have little time for the contemplative thought so traditional in university life. Yet they are part of an exciting enterprise with very fundamental sociological implications, and I inferred that this is sustaining them.

A few of those with whom I talked wondered whether their current work represented an irreversible change from the goals and interests developed during their graduate studies. When I asked about the rewards they expect from the work they are doing, the responses were somewhat fuzzy. The University is too new for them to know about promotional opportunities within the system, and the team approach in developing the educational materials may tend to create a degree of anonymity for the contributors. The conditions under which they were hired included the inducements of time for research and adequate holiday time. Very few have been able to take extended holidays or devote much time to research because of their work loads. However, the initial plan for the University included a postgraduate research facility at the center for faculty and future on-campus students. Perhaps this facility will be developed when people get the time (some staff doubt that this will ever be a significant part of the University). When will they get the time? Well, only a few of the second-year courses are developed and third-year materials are still only vaguely designed. If the intended program leading to the PhD is realized, still more materials must be originated. Then, too, it has been decided that the general courses will be up-dated every four years, while there must be a continual monitoring and iteration of the ancillary correspondence material, examinations, etc. Certainly, there must be a slackening of the present pace in the next four to five years. Then some of the concerns which are now only projected may surface. I think the system, as planned, can handle them. In the meantime it is functioning on dedication.

Additional strains may be placed on the faculty members when dealing with BBC production teams, primarily the television teams (radio production presents no serious problems). BBC has in the past produced educational shows of its own and to do so developed a staff which includes some science PhDs. The production staff owes its allegiance to BBC, not to the Open University; and advancement, promotion, and recognition are determined by BBC's policies. The BBC staff and facilities are based in London, some 50 to 60 miles from the University. If in the initial phases of a new production differences of opinion develop between the Open University staff and the BBC staff, there may result a bit of foot-dragging in hopes of capitulation. If the foot-dragging is too protracted, there can result a furious pace by both teams as a deadline approaches and some sort of compromise has been reached to meet it. It is difficult to assess the seriousness of this situation. Some more reasoning faculty members recognize, accept, and value the unique expertise of the BBC; others feel that they now know enough about TV production to call the shots. It is quite probable that next year the TV filming facility will be moved to the Open University center, but it is not clear to whom the production staff will be reporting. I do not want to overdraw the situation because it is most reasonable to expect as broad a spectrum of types of interactions as there is a spectrum of individuals involved. But the present organizational arrangements are such as to expect honest differences of opinion to be difficult to resolve. I do not believe that the present arrangements have detracted from the quality of the material, but there certainly may be additional pressures on faculty members, as well as BBC staff, resulting from them.

The five or six faculty members I talked with were relatively young, especially for the academic rank they held. Each showed intense dedication to the concept of the Open University, and each was working at a very intense rate. Each had obtained his position in competition with nine or ten others. There is no question but that the financial remuneration and the faculty rank offered exceeds that of standard universities, but I suspect that these inducements were secondary to the commitment to more universal higher education. The on-campus faculty lives and works in a location removed from the UK cultural and educational centers. (Academics from the Universities do sometime participate in the TV presentations and, if time permits us, their role will be examined in a subsequent article.) They have no time to pursue the traditional research interests developed during their own graduate studies. They have duties for coordinating with publication and TV-radio specialists unknown to the usual academic. They have little time for the contemplative thought so traditional in university life. Yet they are part of an exciting enterprise with very fundamental sociological implications, and I inferred that this is sustaining them.

A few of those with whom I talked wondered whether their current work represented an irreversible change from the goals and interests developed during their graduate studies. When I asked about the rewards they expect from the work they are doing, the responses were somewhat fuzzy. The University is too new for them to know about promotional opportunities within the system, and the team approach in developing the educational materials may tend to create a degree of anonymity for the contributors. The conditions under which they were hired included the inducements of time for research and adequate holiday time. Very few have been able to take extended holidays or devote much time to research because of their work loads. However, the initial plan for the University included a postgraduate research facility at the center for faculty and future on-campus students. Perhaps this facility will be developed when people get the time (some staff doubt that this will ever be a significant part of the University). When will they get the time? Well, only a few of the second-year courses are developed and third-year materials are still only vaguely designed. If the intended program leading to the PhD is realized, still more materials must be originated. Then, too, it has been decided that the general courses will be up-dated every four years, while there must be a continual monitoring and iteration of the ancillary correspondence material, examinations, etc. Certainly, there must be a slackening of the present pace in the next four to five years. Then some of the concerns which are now only projected may surface. I think the system, as planned, can handle them. In the meantime it is functioning on dedication.

Additional strains may be placed on the faculty members when dealing with BBC production teams, primarily the television teams (radio production presents no serious problems). BBC has in the past produced educational shows of its own and to do so developed a staff which includes some science PhDs. The production staff owes its allegiance to BBC, not to the Open University; and advancement, promotion, and recognition are determined by BBC's policies. The BBC staff and facilities are based in London, some 50 to 60 miles from the University. If in the initial phases of a new production differences of opinion develop between the Open University staff and the BBC staff, there may result a bit of foot-dragging in hopes of capitulation. If the foot-dragging is too protracted, there can result a furious pace by both teams as a deadline approaches and some sort of compromise has been reached to meet it. It is difficult to assess the seriousness of this situation. Some more reasoning faculty members recognize, accept, and value the unique expertise of the BBC: others feel that they now know enough about TV production to call the shots. It is quite probable that next year the TV filming facility will be moved to the Open University center, but it is not clear to whom the production staff will be reporting. I do not want to overdraw the situation because it is most reasonable to expect as broad a spectrum of types of interactions as there is a spectrum of individuals involved. But the present organizational arrangements are such as to expect honest differences of opinion to be difficult to resolve. I do not believe that the present arrangements have detracted from the quality of the material, but there certainly may be additional pressures on faculty members, as well as BBC staff, resulting from them.

How are the students doing? After the first year, all that can be said is "Fantastic." About 80% successfully passed the courses. Outside examiners were very favorably impressed with the course content and with the level of performance. Although no statistics are yet available, some faculty members think that the first year enrolees, some 25,000, may have represented the "cream of the crop." The average student age was around 27, but I was unable to find out the range. No one is willing to venture a guess on how many will go on to receive degrees. But if present costs are maintained, it has been estimated that if 40% of last year's class finally do receive degrees, the cost to the British Government will be one-fifth that of a degree from the conventional university system.

The word most commonly used by the faculty to describe the students is "mature," mature in their approach to the subject matter and responsible in their observation of obligations. Upon deposit of £10.00 each, 8000 students were sent experimental equipment kits for use in a foundation course in science. The value of each kit was actually £150.00. At least 90% of the kits were returned in perfect condition; after closer tabulation that 90% may be considerably higher. The questions we all have about how the students perform over the long run must obviously await more experience, but based on the experience of one year hope is very high.

The Open University is not unaware of the importance to others outside the UK of what it is doing. The center has been visited by distinguished educators and politicians from many countries. Some ten US institutions of higher education are in active negotiations with the Open University. The interest from abroad varies in extent; there is interest in specific texts, films, or experimental kits as well as interest in the total system. It is the total system concept which the Marketing Director feels others should particularly examine. The course materials and techniques are totally integrated. This he feels is a unique attribute, but he is quick to admit that some modifications may be required for different cultures. Written and verbal course materials are being translated into other languages in cooperation with the Open University. Some of its new texts, particularly one in sociology, have become best sellers in their own right; the experimental kits are expected to be similarly received in future. The Marketing Director feels that North America will be interested in Open University techniques and materials, particularly the community college system developing in the US. I got the impression that through the Marketing Division the University would show considerable flexibility in adapting its educational materials to the various situations in which they may be useful to purchasers.

US educators and planners should take quite seriously this new system for mass education. Nowhere do we have experiments on such a vast scale with techniques which might prove less expensive, while maintaining and perhaps even improving quality compared to our more traditional approaches. Perhaps it may not be desired to import the British system in toto, this is left to experts to decide, but at the very least we may want to examine the Open University's results and experiences and adapt those aspects most appropriate to US needs. (W.J. Condell)

THE UNIVERSITY OF TOKYO: AN INTRODUCTION

The University of Tokyo is Japan's premier university, the institution from whence, traditionally, many of its leaders, its important professors, scientists, engineers, and other professionals have graduated. Even today, among the hundreds of colleges and universities of Japan, many of them internationally famous, Tokyo University is outstanding. It is, probably, difficult to rise to a position of significance in Japan without being a graduate of Tokyo University.

I have seen and visited the University a number of times, both in summer and in winter, and esthetically, it could be regarded as beautiful if one closed one's eyes to the run-down appearance of everything. To be perfectly candid, the unfortunate appearance of many parts of Japanese universities always comes as a shock to me when I visit them, knowing beforehand the generally excellent nature of their work, and the high international reputation of the individual professors. I was particularly disappointed to see the appearance of a building which was brand-new on my last visit two years ago. Today, many parts of it look as though they were from the time of Commodore Perry.

The unfortunate neglect of the physical plant seems to have its counterpart inside also. Not in the appearance of the offices which are the responsibility of the individual professor, but in the appearance of the laboratories. Some years ago, I had thought that this is the way the Japanese do their best work, much in the same manner as my favorite auto mechanic is surrounded by bits and pieces of cars in his garage. But, there is an apparently simple explanation - no money! Tokyo University is a state university with no private funds of its own. A visit to any laboratory of a private company reveals enough modernity and cleanliness to create an entirely different impression, one of cleanliness being next to godliness. Japan is a land of contrasts!

This is a brief introductory report on Tokyo University, its organization, and its engineering college. It is the first of a series of such reports on four Japanese universities, Tokyo, Kyoto, Osaka, and Kobe.

My recent visit was peaceful. Two years ago I saw at first hand the chaos created by the student riots, the damage to buildings, the lock-out of professors, and the excitement of everyone. Interestingly, and quite the opposite of what happened in the US and elsewhere, the students gained absolutely nothing. The legacy which remains are the gutted buildings which no one will repair. The government insists it is the students' responsibility, but the students are as poor as church mice and in no position to pay. The damage remains, and as the months and years roll on, no one seems to notice it anymore.

Prof.-Dr. Toshie Okumura is the Chairman of the Department of Civil Engineering, and quite possibly the leading structural engineer in Japan. He holds a number of university posts, is internationally famous, on the boards and committees of international engineering organizations, the president of the Japan Welding Society, and above all, he is a complete gentleman. I was very fortunate to have spent a whole morning with him in his office and to inspect some of the laboratories, as well as the Computer Center. (These will be described in a separate report.) Having spent a year at the University of Illinois many years earlier, and having since then traveled extensively in the world, he has no illusions about what his University is.

Tokyo University was founded in 1877 with the Departments of Law, Science, Literature, and Medicine. Its origins, however, go back to earlier establishments, the first in 1789. There is now a College of General Education, nine independent Faculties, and a Graduate School. The Faculties are those of Law, Economics, Letters, Education, Engineering, Science, Agriculture, Medicine, and Pharmaceutical Sciences. The Graduate School has 10 divisions: Humanities, Education, Law and Politics, Sociology, Economics, Science, Engineering, Agricultural Sciences, Medical Sciences and Pharmaceutical Sciences. There are also a number of Institutes: of Oriental Culture, Social Sciences, Journalism, Historiography, Infectious Diseases, Earthquake Research, Industrial Science, Applied Microbiology, and the Tokyo Astronomical Observatory, as well as the Cosmic Ray Laboratory at Mt. Norikura. There are also institutes concerned with nuclear study, solid state physics, ocean research, and space and aeronautical science. There are another dozen or so affiliated institutes for medical, biological, botanical, engineering, and veterinary research. Thus, with an elite undergraduate student population of 13,000, the cream of the cream, and a graduate student population of 7000, the University is of a size to have an influence in most areas; an influence far greater than one would expect from the numbers alone.

Engineering education in Japan started in 1868, and the then Engineering College was absorbed into Tokyo University in 1886. (The early graduates started a tradition still continuing, of supplying the faculty to the nation's universities, by establishing the Faculty of Engineering at the University of Kyoto in 1897.) Currently, the Faculty of Engineering has 20 departments with 135 professors, 130 associate professors, various lecturers, assistants, and 1800 students. The Division of Engineering in the Graduate School has about 1200 students for the master's and doctorate degrees, in the ratio, respectively, of about two to one. It is not surprising that there are only about 30 foreign research students, since the foreign student has no special privileges, and must know Japanese. There are no facilities on the campus for foreigners to learn Japanese.

No doubt the divisions of the academic year have some historical significance, but they seem rather inefficient with the Summer semester running from April 1 to October 20 including recesses from April 1 to April 7 and from July 11 to September 10. (The Winter semester doesn't have such interruptions.) Under the present system, the first $1\frac{1}{2}$ to 2 years of the undergraduate's education is at another campus - at which time he decides on his major, that is, engineering, science, law, etc. The final $2\frac{1}{2}$ years are on the main downtown campus. About 40 students per year join the Civil Engineering Department, so that there are 120 undergraduates at any one time. This is in addition to the 80 graduate students. There is a limit of 22 new students each year for the master's program, which takes two years to complete. There are no specific limits in the PhD program; about seven are accepted into it each year, and it usually takes about three years to complete all requirements. Civil Engineering is an average-size department and Metallurgy is the largest with almost double the number of chairs, although with the same number of students. The system may appear familiar - it should, since it reflects the changes ("Americanization") instituted by General MacArthur in the occupation days - the prewar university education system was essentially Germany in origin.

The Civil Engineering Department is divided into seven divisions: applied mechanics, transportation and traffic engineering, harbor and coastal engineering, soil mechanics and foundation engineering, hydraulics and river engineering, bridge and structural engineering, and concrete and materials engineering. It is of interest to dwell a little on the system of departments and divisions, as it appears to be universal throughout the Japanese state university system, and somewhat similar to that in many European universities. Each division (or "chair") is allowed one full professor, and one associate professor or lecturer, plus one assistant, all three of whom will normally have a doctorate. They are paid by the University. If there are additional assistants, their salary comes from research funds. This system is quite restrictive, particularly since seniority governs promotion. Thus, the opportunity to move upwards into either the professor or associate professor slot is given first to the man who has waited longest, irrespective of the division he is in or interests he has, and, in some cases, regardless of the department he is in if the field is closely allied. Often then, a man must change interests in midstream, as there is no other way for promotion. Sometimes it may be possible for the scope of the chair that the new professor occupies to be changed slightly. Some persons may have to wait decades for promotion, others just years, depending entirely on the health, age, or prospects of those ahead!

Substantial amounts of research are underway on the campus; about \$120,000 annually in the Civil Engineering Department, of which Okumura is responsible for over a third. This is a great deal of money as the professors are paid by the University and there is no need to pay the graduate students who are assisting as part of their thesis studies. Also, overhead is apparently nominal. However, the salary of a professor's secretary, if he has one, and the stationery she uses, must come from the research budget. Advance planning is possible, and many projects last five or six years. Very few research funds come from private companies, since it is extremely difficult to obtain, as opposed to the system which has evolved in obtaining support from the various public authorities. Okumura feels very strongly that there is need for a central government research agency such as the NSF.

Since the University is a government one and the professors are civil servants in the Ministry of Education, consulting as we know it is not normally allowed. However, each professor is allowed to receive up to a maximum of \$3000 annually from various public authorities, for what is, as far as I can see, another form of consulting. Most professors seem to have this "slush fund" and use it generally for traveling overseas to attend conferences. (An overseas trip plus expenses will add very quickly to about \$2000, since Japan is so far from everywhere!)

A typical research contract between the University and a public authority is the combined one between the Divisions of Applied Mechanics, Transportation, and Bridges (in the Civil Engineering Department) on the one hand, and the Honshu-Kyushu Bridge Authority on the other hand, for about \$65,000 per year. (It sounds more impressive if I use the actual figure of 20 million Yen per

year!) Other contracting public authorities are, for example, those of the Electric Power Supply and the Railway Construction Corporation.

I spoke also at length with an old colleague of mine, Prof.-Dr. Yuzuru Fujita, of the Naval Architecture Department. He made it very clear that the amount of research a professor has and the sources of his research funds are entirely his own business. In fact, this information is not published, or normally even discussed with one's colleagues! It just isn't done. Fujita was, however, quite open with me. He has about $45,000 a year in research projects, both governmental and private. There is absolutely no obligation to conduct research or to publish - the professor has tenure, and he can't lose his job. He is, in effect, responsible to no one but himself.

Many Japanese in the engineering fields have spent some time abroad, and a large proportion have received doctorates at American and European universities. Interestingly, these foreign doctorates do not have much prestige in Japan, and really only amount to a certificate of having spent a certain number of years at a foreign research institute. To become a professor at a Japanese university, it is almost mandatory to have a Japanese doctorate. Thus, all of the professors I met who had American doctorates had also worked for, and received, a Japanese doctorate soon after their return from the US! Some of the younger men think it ridiculous, but most realize that the system can't be bucked.

The 20 Departments in the Faculty of Engineering are enumerated below. (Some will appear very similar; this reflects what seems to be one of two ways in Japan to legally obtain more professors, that is, to set up a similar, but slightly different, department. The other way is to create more divisions in a department.): Civil Engineering, Architecture, Urban Engineering, Mechanical Engineering, Mechanical Engineering for Production, Marine Engineering, Precision Machinery Engineering, Naval Architecture, Aeronautics, Electrical Engineering, Electronic Engineering, Applied Physics, Mathematical Engineering and Instrumentation Physics, Nuclear Engineering, Mineral Development Engineering, Metallurgy, Industrial Chemistry, Synthetic Chemistry, Fuel Engineering, and Chemical Engineering.

The University of Tokyo is a university of the elite, and the heart of the nation; it has an excellent faculty, and many excellent facilities. It is, therefore, petty of me to draw attention to its shabbiness. But, I hope that the predicted Japanese attack on problems at home, such as pollution, housing, and the quality of life, will be reflected in the restoration of the University to its beautiful prewar state, and to a condition comparable to most other universities in the world. (L. Tall)

ENGINEERING

THE IRA AND THE STRUCTURAL ENGINEER

The events in Northern Ireland have been quite unfortunate, to say the least. The February explosion of an Officers' Mess in Aldershot, not too far from London, has been claimed by the IRA as their doing, and they have further claimed to have used 280 lb of gelignite.

What is of particular interest to the structural engineer is the fact that the Aldershot mess hall did not collapse from the effect of this huge blast. The walls had been blown away completely from one half of the building, but the structural frame of reinforced concrete remained intact. I found the reason for this in an article in the back pages of the London Times -- the mess had already collapsed completely during construction eight years ago and had been rebuilt! At that time, it was one of a number of buildings being constructed using precast panels, in fact, the Times' article stated that the building system was the same as that used in the Ronan Point apartment building which suffered so disastrously some four years ago (See ESN 22-9, 243), and which brought a complete re-appraisal of the use of precast reinforced concrete panels for tall buildings.

The Aldershot collapse of eight years ago was apparently reported in detail in a White Paper of the Building Research Station which was quite "comprehensive and damning." It stated that "reinforcing rods had been cast out of position, there was little continuity of reinforcement between one beam and the next. Above all, there was a complete lack of any cross-bracing to the structure in the open-plan mess-rooms on the

first floor, where there were no dividing walls." At that time, military buildings served as a testbed for the push by the Ministry of Public Building and Works to expand the market in prefabricated building systems.

Further, the Times' article points out that the White Paper was a "terrible forecast of the technological nemesis" which was to befall prefabricated building after the Ronan Point disaster. It notes also that the later tragedy might have been averted if the White Paper had been accepted, "but prefabrication was the height of fashion, and the report was noted only briefly in the technical press."

The interesting feature of all this is the fact that the Aldershot mess hall and three or four similar buildings were reconstructed after the first collapse, this time with monolithic concrete poured at the site, and not with precast units.

The article concludes with a brief statement on the "enormous traditional strength" of poured concrete, as opposed to that of a building with pre-fabricated panels. In fact, the headline for the article said it all quite succinctly: "No System Meant Strength." (Lambert Tall)

TOKYO UNIVERSITY: FINITE ELEMENTS AND FRACTURE MECHANICS

Some interesting studies are underway at Tokyo University in the Department of Precision Machinery Engineering under the direction of Dr. H. Miyamoto. Miyamoto is professor of the theory of elasticity, plasticity, and material science. Although I wasn't able to meet him during my recent stay at the University, I did learn of his work in applying the finite-element method to fracture mechanics.

Miyamoto has been looking at crack initiation and propagation, three-dimensional stress concentrations, and the finite-element method for some years, and partook in the Japan-US Seminar on Matrix Methods of Structural Analysis and Design, in Tokyo in 1969.

He has combined the traditional analytical method with the finite-element method in the study of crack initiation and propagation. While the analytical method is quite accurate in studying stress concentrations at a crack tip, it has little use elsewhere; likewise, while the finite-element method describes the behavior of the complete structure, it breaks down at a nodal concentration. The finite element method is applicable also to elastic, elastic-plastic, and plastic conditions.

Miyamoto's studies have been applied to a number of examples:

- theory of elasticity by finite elements; two-dimensional, axi-symmetric, three-dimensional, and torsional problems.
- stress intensity factor in an elastic solid by finite elements.
- stress concentrations by the incremental theory in an elastic plastic solid by finite elements; two- and three-dimensions; torsion.
- cyclic loading; the cracked plate and plane stress analysis by finite elements; elastic-plastic behavior; internal crack and double-edge crack; crack under completely reversed stress.

Miyamoto has proven the application of finite elements to fracture mechanics, and his study of cyclic loading is particularly impressive. His analysis of the cyclic loading case may be summarized by the following results: complete distribution of stress, strain, and plastic strain energy ahead of the crack tip; change in plastic zone due to the loading cycle; relationship between stress intensity factor, K, and crack-opening-displacement, COD, at the crack tip; displacements of the crack surface for both pulsating load and completely reversed load. (Crack closure observed only for the completely reversed load.) (Lambert Tall)

CTICM, PARIS

The Centre Technique Industriel de la Construction Metallique is, very approximately, the French equivalent of the American Institute of Steel Construction. The literal translation of its name is the "technical industrial center for metallic construction."

There are very many centers and institutes in France with similar sounding names, for instance: Centre Technique de l'Aluminum, Centre Scientifique et Technique du Batiment. The CTICM belongs to that group known as "Les Centres Techniques Industriels" created by a government law of July 1948. The CTICM and its relationship to these other centers will be described in a report in preparation. This present article summarizes CTICM's purposes and accomplishments.

CTICM was created in 1962, and receives its funds from a fixed percentage of the income of the French fabricating industry, members of which sit on its Board of Directors. The French government also participates in this board, and has the power to veto. Thus, strictly speaking, the CTICM is neither a state organization nor a private concern, but might be called an instrumentality of the French fabricating industry operating under strict government control.

My association with CTICM began with a visit I made there in the summer of 1967. Since then, I have been a frequent visitor, and indeed, a collaborator as well. One of my research projects at Lehigh University was the first in structural engineering in the US to be financed from Europe, by the European Convention of Constructional Steelwork, in this case, in association with the National Science Foundation. It seems that the European Convention, although not dominated by its French members, feels their presence very strongly. This may be due to the fact that the CTICM is an extremely strong and wealthy organization when compared to its counterparts in the other countries. In any event, almost by default, my European association on this research project became a French association.

By law, the objectives of the CTICM as given in its Statutes, are the following, abbreviated here. (I have used the word "steel" rather than the original French "metallic", since steel is the only metal being considered by CTICM.

The objective is to promote programs, to participate in the improvement and the guaranteeing of quality in the constructional steelwork industry. Notably to:
1. study technical problems, solutions, and specifications and to coordinate them;
2. establish technical liaison and cooperation in the various related fields, including foreign;
3. participate as the technical representatives of the profession in both national and international undertakings;
4. initiate experimental studies;
5. establish a reference center for French and foreign works;
6. undertake all research needed;
7. study the specifications, safety, and to participate in commissions of enquiry;
8. publicize the teaching of steel construction;
9. assist in the training of engineers, technicians, and apprentices in the profession.

The CTICM has made steps in all these directions. Although many aspects such as training are still in a formative stage, the foundation has been made so that they are an important group who make their weight felt in Europe.

Recently, I spent a few days there studying the complete organization. I spoke with Lucien Wahl, the comparatively young, personable, and dynamic Managing Director, who has had the responsibility of starting the CTICM from its inception and of bringing it to its present powerful position. He told me of the beginnings of the group, basically on the initiative of the state to get progress in the area of steel fabrication. The fabricators must participate with 0.4% of their gross income, which, most recently, has meant an annual budget of about $800,000 for CTICM. The research they are doing accounts for about half of this money. As could be expected, the compulsory nature of this contribution does not make every fabricator happy. On the other hand, the government apparently feels that it should be collecting this money as a tax, and then transmit a certain amount to CTICM. Thus, CTICM must walk a tightrope between these opposing forces. A number of study groups have tried to change or reinterpret the law as it now stands -- so far with little success. We discussed some of the problems of bidding in France. Wahl felt that their method leads to great inefficiency -- bids are let by the owner's architect to the half-dozen or so companies bidding, and then each must make his own design with no guarantee, of course, that he will get the job.

I spent some time also with Jacques Brozzetti, the Assistant Director for Research and a former graduate student in the US. (His immediate boss, Duiliu Sfintesco, Director of Research, was out of the country at the time. Sfintesco is well known in North America for his interest in fire, wind, and tall buildings.) Brozzetti has been in an excellent position to capitalize on his contacts with the latest US research in structural engineering, and to continue certain aspects of it in France. He felt that there had not been any real organization of research until comparatively recently, mainly because of the difficulties of starting up the new organization -- and he felt that this had led to some loss of efficiency. Recently, he helped reorganize the research activities, initiate long-range planning with a five-year plan, and broke the research into a number of general areas. This was all part of an overall reorganization when the CTICM was divided into eight divisions: Research, Architecture (that is, structural design), Technology, Education, Computers, Consulting, Documentation, and Administration. There are currently about 65 people in CTICM, over half of whom are engineers.

CTICM does not conduct any research of its own, except for a few theoretical studies; it has no experimental facilities. They sponsor research at universities and other institutes, and sometimes

in association with other groups, such as the Highways Department. The research currently underway is summarized:

1. Stability: web buckling in plate girder bridges (co-sponsored with Highways and Public Works Departments); corner connections; column buckling; probabilistic studies of buckling of structural members; light-gage cold-formed members.
2. Assemblages: bolted joints; welded joints; high-strength bolts; plastic analysis and design.
3. Wind Effects.
4. Fire: building station at Metz, France.
5. Computer Methods.
6. Specifications and Safety Factors.
7. Crane Girders.

André Pousset, the head of the Technology Department, is a very volatile man whom Americans would tend to identify as "typically French." He spoke so fast and so excitedly that it was easy to become enthusiastic with him, even though I lost some of what he said. I was a little confused to learn that he is also a professor at the Ecole Centrale. (A number of CTICM's officers have dual appointments.) It appears to me that his team of five or six engineers act in liaison between CTICM and industry. They perform a service to industry by organizing seminars to explain modern advances, and by giving advice and consultation, and by arranging studies and research needed by industry. They have, for instance, assisted companies with the application of computers for the programming of planning, and with the development of systematic methods for the straightening of structural members after welding.

Each of Pousset's engineers has one of the following specialties: consulting with industry, computation of deflections of structures due to welding, programming production schedules, composite bridge construction, and liaison with all necessary groups - industry, research, and administration.

Pousset was very vocal about some segments of the French construction industry -- they have a big resistance to new ideas, were old fashioned, and did not follow up on what they learned! He noted also that steel prefabricated housing is not as yet an economical proposition in France. Their application of Okerblom's studies to the prediction of the straightening of welded members had not been successful. (This was no surprise to me, it was a surprise that they had even tried to follow up on Okerblom's work! The late Okerblom, a well-known Russian welding engineer, made many complicated theoretical studies of thermal deformations, but his studies are much too theoretical to be of practical use.)

Admiral Henri Amiot and General Francois Guelfi appear to be the mainstays of the Education Division. Both are retired military men who have very important contacts with various French government offices. I had an extremely long conversation with Amiot, who is very much aware of the idiosyncracies of French laws and of the current developments in professional education for engineers. We talked about the professional registration of engineers, and their responsibility in building collapse. The title of engineer is a very definite and clear one -- it indicates that the person has graduated from one of the engineering universities. The question of responsibility in a collapse is not clear - usually the owner of the building or structure is responsible, but in some cases it could be the engineer. The engineer never loses his title after a collapse, but he probably will lose his clientele. Apparently the engineering profession is very badly organized in France, and aside from the title of engineer, there are no rules for codification.

Amiot was very excited about a law on continuing education, part of a set of laws called the Law of 16 July 1971. ("Formation Professionelle, Education Permanente, Apprentissage, Enseignement Technologique, et Participation des Employeurs. Lois du 16 juillet 1971.") The law is about 50 pages long in a booklet form. It appears to be a complete reorganization of the possibilities for engineering education in France -- including the possibility for continuing education, and the role of the employer in this.

One of the important recent tasks of the Education Division was to bring together all the various civil engineering and structural engineering schools throughout the country with a view to more coordination in courses, as well as taking preliminary steps in creating a post-graduate, technical university education for engineers. At this moment, it is not possible for a structural engineer, for instance, to recieve a doctorate in structural engineering -- he would have to go through one of the mathematics or physics departments, and his degree would be in the field of that department. They have regarded this as being quite inhibiting for the development of the engineering profession.

Perhaps the youngest division is the Computer Division -- youngest in the fact

that the five engineers are all in their early 20's, including two young and quite pretty ladies. Of the group, two are graduates in information sciences, the rest being engineers. Four of them sat with me around a table in their computer kingdom, and two hours went by rather fast. Much of the conversation was about STRUDL, an MIT-originated computer program for the automatic design of certain structures. STRUDL is quite well-known in the US, its original version having long been superseded by modifications and more sophisticated programs. It is, however, a most logical first step for CTICM, and the group has had much experience in adapting it for use in the French specifications. This was not particularly difficult, as the analysis side remains valid. The group is quite apprehensive about developing from scratch their own programs for design -- even though it is obvious to me that they have the capability, and, in any case, will attempt it when their current shake-down period is over. Even though they are spending a lot of time on STRUDL, which isn't too original, they are the French pioneers of computer-aided design. They are also starting to work on automatic plotting, and in addition, they have a number of smaller programs for minor items such as influence lines, and a program for fabricators to cut a number of small plates out of large ones with the least waste.

The Computer Division sells its services to the industry, and uses the IBM 360/175 and 360/165 located at the IBM Center in Paris -- they have two terminals in CTICM itself. They feel that they have no choice but to use IBM, even though France is unhappy about this American influence -- but the French or European computer companies apparently just cannot furnish them with the services they need. The Division helps the Research Division and the other divisions of CTICM as needed, they teach some seminars (such as, recently, one on the method of displacements), and in general, keep up to date with the new methods. The division's budget for 1971 was about $200,000, about 2/3 of which came from "exploitation", the fees from services rendered to the various companies. They project a 50% increase in activities for 1972, with the acquisition of two additional engineers.

The CTICM is a look-ahead and dynamic organization in the American style, run by generally young engineers who seem to know where they are going, and who realize that they have an important responsibility in bringing the use of structural steel in France up-to-date as fast as possible. (Lambert Tall)

MARINE BIOLOGY

KUNDUCHI MARINE BIOLOGICAL STATION, TANZANIA

In 1967 the University of Dar Es Salaam, located at approximately 7° South on the east coast of Africa, built a small marine laboratory on the shore at Kunduchi. Located ten miles from the main campus, the facility was designed initially as a base for undergraduate courses in marine ecology and also served as a center from which research workers could conduct their field work. It was administered by the Zoology Department of the University and was supervised by the staff who had full-time teaching duties within that Department. This arrangement continued until September of 1970, at which time certain changes were brought about which were designed to improve and provide more complete utilization of the existing facilities.

During this same period, a Fisheries Institute, part of the Ministry of Tourism and Natural Resources, developed on an adjacent site. The Fisheries Institute at present is considerably larger than the University facility, both with regard to staff and buildings. It conducts a two-year diploma program in fisheries and carries out research which is of direct application to fisheries development. Within the last two years it was decided that the University Laboratory should be further developed as a center of Marine Biological Research, staffed by resident personnel engaged in teaching and research on a full-time basis.

At the present time, as a result of the modifications which are currently under way, the scientific staff consists of one senior lecturer, one lecturer, two tutorial assistants, one postgraduate student (from Kenya) and one part-time research associate. Physical facilities consist of a laboratory building of approximately 300 m^2, including offices, storerooms, and four research-teaching laboratories. It is equippped with the usual freshwater, electricity, bottled gas and is partially air-conditioned. There are ten large aquarium tanks, each with a capacity of 1800 liters. Although there is a seawater system, the design is reputed to be quite poor, and its replacement is considered to be a very urgent priority. The large lecture theatre, which purportedly is used very rarely, is shared by the Marine Biological Station and the Fisheries Institute. Between the two facilities there is a two-story "rest house," with the upper floor designed for living accommodations and the lower floor for stores and workrooms.

From correspondence with one individual associated with the Laboratory, it would appear that renewed efforts are being made to expand the resident staff and improve the physical plant of the Laboratory. The feeling was expressed that there should be a minimum of five scientists with some postgraduate training, in addition to a number of postgraduate research students. Efforts are being made to attract foreign scientists but, at the present time, the physical plant and available equipment are not adequate for many of the more sophisticated research programs. As so frequently happens, the seawater system seems to be a major problem. At the present time it can be operated only when the sea level is 2½ ft or more above mean tide level. Because of local conditions, this means that it cannot be operated for several days in a row, and since no storage facilities are available, running seawater is completely cut off during that period. Inasmuch as Kunduchi is ten miles from the campus, living accommodations are considered to be essential for attracting visiting workers and students.

Although titles of publications were not available, it would appear that much of the research thus far involves a general survey of the area, certain taxonomic studies on local fauna, and some preliminary behavioral studies. Anyone desiring additional information should write directly to Dr. R.G. Hartnoll, Senior Lecturer-in-Charge, Kunduchi Marine Biological Station, Kunduchi, Tanzania. (J.D. Costlow)

6th EUROPEAN SYMPOSIUM ON MARINE BIOLOGY

The first European Symposium on Marine Biology to be held in a Communist country was scheduled for Rovinj, Yugoslavia during early October 1971. Hosted by the "Rudjer-Boskovic" Institute, the meetings were held in the Hotel Katarina on the small island of Katarina immediately opposite the old town of Rovinj. In addition to support

from the Institute, both the Federal Council for Coordination of Scientific Activities, Belgrade and the Fund for Scientific Research of the Republic of Croatia, Zagreb contributed to the organization and financial support. The two general themes were "Biological Productivity in Shallow Water" and "Dynamics of Benthic Communities." Approximately 200 scientists from 24 different countries gathered at the Hotel Katarina to discuss these two topics which, unfortunately, were set up all too frequently as concurrent sessions.

The host institution, the "Rudjer-Boskovic" Institute, was founded in 1950 and today includes more than 700 staff members, 162 with PhD degrees working in eight departments ranging from applied research in the natural sciences, theoretical physics, oceanography, and including teaching at the University and postgraduate level in a wide variety of disciplines. The headquarters of the Institute is in Zagreb and it is only the Center for Marine Research that is located at Rovinj. This portion of the Institute was organized in 1969 and combined the previously established Marine Science Laboratories with the Institute for Marine Biology of the Yugoslavic Academy of Sciences and Arts. The Marine Center itself has 77 staff members, 34 of whom are involved actively in marine research. At the present time the Center is organized into eight research units; a laboratory for ecology and systematics, a laboratory for organic production in biochemistry, one for molecular biology, a group for fishery and marine aquaculture, a division for physical-chemical separations, a laboratory for electrochemistry, one for radio-ecology and nuclear chemistry, and a special laboratory for electrophoresis. The physical plant at Rovinj involves approximately 550 m^2 and a new research building of approximately 3600 m^2 is planned for the near future.

The research activities of the Center cover a wide range that includes studies on the hydrography of the North Adriatic, the physical-chemical forms of seawater microconstituents, surface phenomena, sediment-seawater interactions, flora and fauna of the North Adriatic, ecology with special reference to benthic communities, population dynamics of economically important Clupeides, primary productivity, phytoplankton variations in time and space, specific pollution studies (radionuclides and heavy metals) and ecophysiology of coastal organisms. The Center's building in Rovinj is reasonably well equipped with the standard instruments and also includes facilities for low-level data counting with automatic anticoincident counters and equipment for analysis of various radionuclides. In the Center's laboratories in Zagreb additional equipment is available for polarographic work, neutron analysis, and computer programming.

The Center maintains a library of approximately 12,000 volumes and receives about 380 serial publications on an exchange basis. The R.V. VILA VELEBITA was purchased in 1969 for the Center, is 26m long, can accommodate six scientists, and has basic facilities for collecting and conducting research in the North Adriatic. A portion of the Center's program ties into teaching and about 500 students per year attend short courses, primarily in the field of marine biology.

Although it was natural that many of the papers in the realm of "Biological Productivity" should pertain to Adriatic conditions, a number of speakers from other countries did present information applying to other shallow-water areas. The one participant from Bulgaria, Mme. Petrova-Karadjova, discussed seasonal variations in phytoplankton in the Black Sea off the Bulgarian coast and a number of the Scandinavian participants spoke on conditions in the Baltic. There was the usual consideration of the relationship between phytoplankton and productivity, bio-productivity of in-shore waters versus the open seas, fluctuations in photosynthetic activity in relation to environmental conditions, and the distribution of radiant energy at specific depths and latitudes. Several speakers, including Soderstrom of Sweden, considered the relation between nutrient concentrations and productivities in coastal waters, and Levi (Laboratorio-Tecnologia-Pesca, Ancoa, Italy) took the general topic one step further to include a discussion of pigment analysis as a possible tool in the estimation of reproductive rates of phytoplankton and its grazing rate by herbivores at sea.

The concurrent sessions on "Dynamics in Benthic Communities" presented a somewhat greater variety of subjects. One morning session concentrated on succession in littoral communities, with

several papers that considered seasonal fluctuations in the composition of marine algae. One afternoon session was directed largely toward a consideration of meiofauna populations. McIntyre (Scotland) spoke on comparative studies of meiofauna populations, and Hulings (Beirut) presented results of a quantitative study of sand beach interstitial fauna in Lebanon. Boaden (Northern Ireland), Reiger (USA), and Giere (Germany) spoke about daily migration patterns in intertidal meiobenthic communities, patterns of short term migrations of Turbellaria in intertidal sediments, and the relations between abiotic factors and microdistribution of marine Oligochaetes in the shore flats of the North Sea respectively. Another section under Dynamics in Benthic Communities considered reproduction and population dynamics of bivalve mollusks (Scheltema, USA), and a number of papers were presented dealing with variability and seasonal variations in distribution of Oligochaetes, crustaceans, and demersal fish.

A third portion of this general theme dealt with the popular subject of pollution in estuarine and marine environments. These papers varied from a straightforward consideration of the effect of waste disposal on marine benthic communities in the New York Bight (Pearce, USA) to modifications of summer Mediterranean communities due to organic marine pollution (Stirn, Yugoslavia). One, by Persoone (Belgium), dealt with the effect of pollution on reproduction of the European oyster in the harbor of Ostend, and another touched on the vicissitudes of effluents from sulphite pulpmills. The fourth series of papers concerned itself largely with the effects of abrasion, sediments, and other natural environmental factors on benthic communities in the Black Sea, the North Sea, the North Adriatic, and the Limski Kanal, Rovinj.

Although several of the papers involved the use of rather sophisticated equipment and presumably improved techniques (largely those given by Reidl, Ott, and Machan), it was a bit disconcerting to sit through five days of papers without hearing any reference to efforts involving mathematical modeling or, for that matter, a proper mathematical evaluation of some of the results. Many of the reports were strictly descriptive, involving general seasonal fluctuations in species, and there was all too little effort to consider the basic causes of the fluctuations or express the results in terms which would permit extrapolation and comparison with other areas.

One would suspect that this was the first symposium involving an international group to be held at Rovinj. Most participants stayed on the island at one of several hotels and were on a "full-board" basis. This did provide for small group discussions and evening "get-togethers," but there was considerable opposition to the $30.00 registration fee. Although there was frequently more than one could really eat, and certainly a great variety of European and Yugoslav dishes from which to choose, no one ever really resolved just why the registration fee should have exceeded that which has been charged for all previous Symposia. A number of tours were set up, including the Center for Marine Research in Rovinj, the Aquarium, and the magnificent Postojna Caves. Although not strictly scientific in nature, there was an interesting boat tour of the coastal area and an excursion to Porec, an ancient town nearby, and to the Limski Kanal, a nearby "fjord," and the site of recent studies on techniques for the culture of Mytilus and other mollusks. A number of special ladies' tours were set up, including a general tour of the Rovinj Archipelago, visits to Roman ruins in nearby villages, and an afternoon tour of a local farm. Communications with the mainland Rovinj was by motor launch which, although it was supposed to operate on half-hour intervals, was rather erratic and, at least for some members of the group, involved situations which were a little out of the ordinary. At least one member of The Netherlands contingent "accidentally" boarded the wrong motor launch and was taken to the Red Island, the site of a nudist beach. As he tells the story, he was refused permission to go ashore because he was too fully clothed.

Many of the younger scientists who have attended three or four of the Symposia were present at Rovinj, although it was a bit disappointing to find that only one representative came from the adjacent Bulgarian scientific community and that the one Rumanian scientist who was scheduled to come had to withdraw at the last moment. If only on the basis of geography, one might have expected some of the Russian scientific community to attend, but this was not the case. As always, a number of younger scientists from the host country were present.

and it was an excellent opportunity for these young people, who do not normally attend meetings that are very far away, to meet and talk with their other European colleagues. One indication that the European Symposia Series is achieving more than just a presentation of scientific information was rather "dramatically" brought home before the end of the conference. A rather well-known French scientist had been scheduled to give a paper and, in accordance with the guidelines laid down by earlier announcements, had listed his title in French and expected to give the paper in French. For reasons which may never be completely understood, he announced his paper in English and proceeded to present it in English. On the basis of this historic event, a colleague from Belgium, who had also intended to give his paper in French, proceeded to rewrite his presentation completely in order to give it in English. All of us, I'm sure, can imagine some number of other European meetings where such an event would have been virtually impossible or might have resulted in the expulsion of the scientist from the lecture hall.

Manuscripts from the Symposium will be published in Thalassia Jugoslavica. For information pertaining to the volume, one should contact Dr. D. Zavodnik at the Rovinj Center. (J.D. Costlow)

MATERIAL SCIENCES

MATERIALS RESEARCH IN ISTANBUL

A day or two before I embark on a trip to some distant unfamiliar land, like many tourists, I madly scan a number of guides and finally cram one into my briefcase to be retrieved to help decipher public signs and translate native menus. Recently upon arrival in Istanbul I discovered among the gastronomic delicacies listed in my guide, issued in 1961 by the Turkish Ministry of Press, Broadcasting and Tourism, were Kadin Budu (fried meat balls) and Kadin Gobegi ("typical dessert"). The literal translation for the first is "lady's thigh," for the second "lady's navel." With discretion, I usually ordered Zeytin Yagh Pathcan Dolmasi (stuffed eggplant).

Turkey, bounded by land frontiers with Russia, Iran, Iraq, Syria, Greece and Bulgaria and over 4000 miles of coastline, has long been considered to be the bridge between East and West. Nearly 97% of its land area is in Asia, the rest in Europe, the separation being provided by the Dardanelles, the Sea of Marmara and the Bosphorus. Istanbul, Turkey's largest city is probably the only city in the world that straddles two continents, and it also claims the honor of having been a city continuously for 26 centuries, longer than any other metropolis. The first settlement was established in 657 BC by Byzas, a general from the Greek city of Megara (where Euclid was to establish his famous Academy three centuries later, to the chagrin of school boys for many centuries thereafter). In 330 AD the Roman Emperor Constantine chose the city, by this time known as Byzantium, to be the capital of the Eastern Roman Empire, changing its name now to Constantinople. Disaster struck in the form of the plague in 542, killing 300,000 and causing the city to go into a long decline from which it was not able to revive until the 9th century. The resurrection was short lived because in 1203 came the Crusaders bringing wanton pillage and destruction. But two centuries later the Ottoman Turks under Sultan Mehmet II recaptured the city and made it the capital of the Turkish empire and the city, now called Istanbul, once again flourished and bloomed. Coming down to present times, Istanbul experienced various disasters during the first quarter of the 20th century, marking the death of the empire and the birth of the republic of modern Turkey in 1923 with Ankara becoming the new capital. More recently there have been violent student demonstrations and drastic measures to curb them. But I saw no outward signs of these problems during my brief visit.

As one is driven from the airport to his hotel, he passes the ancient Byzantine wall surrounding the old city's splendid palaces, mosques, museums, monuments and the mecca of all tourists - the covered bazaar. The driver then takes him across the Galata bridge over the Golden Horn, a finger of the Bosphorus which divides the European part of the city into two. The low ground is the old Genoese colony, the high ground, Beyoglu, is the newer section of the city where

business, government and educational establishments are to be found. Coupled with the charm of this ancient city is the friendly assistance offered to the "stranger within the gates."

In Istanbul my point of contact was Prof. Dogan Gücer of the Technical University of Istanbul. From him I learned that materials research in Turkey is conducted in three places: first, under the Chair in the Mechanical Engineering Faculty of the Technical University, that Chair being occupied by Prof. Gücer himself; second, in the Metallurgy Division of the Mining Engineering Faculty of the same University; and thirdly, in the Metallurgical Engineering Department of the Mid-East Technical University of Ankara. These are the primary research groups. Because my trip to Turkey was a brief one, I was unable to visit Ankara, so this latter institution will not be covered. There also is a well-equipped Turkish standards laboratory in Ankara which does routine studies on materials, and a laboratory within the Army R&D Center whose function is essentially to check specifications and conduct analytical tests. Some research is carried out within these assignments at the latter facility. In addition, materials research is conducted within the Nuclear Training and Research Center which is well equipped but unfortunately, lacks staff. The problem of staff, incidentally, is a serious one almost everywhere in Turkey. There are smaller schools that are just beginning to conduct research, but it would be premature to discuss their programs.

The Turkish Science and Technical Council which was established eight years ago is establishing a research establishment called the Marmara Scientific and Industrial Research Unit, some 30 km from Istanbul which will house six or seven major research units. Two of these have already been designated. They are the Materials Research Unit and the Electronics Unit. Gücer, who is a member of the Council, will head the Materials Research Unit, and has been responsible for its planning with the assistance of Prof. Aladag and a staff of eight others. Progress has been made; the building has been designed and the equipment ordered. In fact, I had a very pleasant visit with the architect and saw the model for the entire research center. The new center will be on a large tract of land, 3 km by 2½ km in size overlooking the sea with railway facilities on one side and a highway on the other. There will be a central administration building from which will jut forth satellite buildings for each faculty represented in the institute. Also, there are plans for a modern auditorium. The architect's model indicates that the grounds will be attractive, and that housing will be available for employees and visitors. With the acreage involved, there is obviously considerable room for expansion without crowding. The plans and models for the two buildings which are about to be completed show that a considerable amount of thought has gone into them. Modern concepts are being used with concern for efficient operation and personal comfort. In the case of the Materials Research Unit, $1.5 million worth of equipment has been allocated to be brought in during the first six years. Occupancy of the building should begin in about a year.

In the above I used the term "Faculty." It should be noted that the Faculty at the Marmara Scientific Center will not be a teaching faculty. The Center will be devoted exclusively to research. A comment might, however, be made about the teaching faculty at the University. Within each Faculty, there tends to be two chairs, and under these chairs are a Professor, a Docent, or Docents and assistants. The Docent is probably equivalent to our Associate Professor: The assistant is equivalent to Assistant Professor. However, the assistant cannot teach, and very often is working for his PhD. Within a year's time this system will be changed to be more similar to the university system in the US. The change has already taken place at Ankara.

I next visited Prof. S. Anik who is the Turkish member on the International Institute of Welding, and obviously, welding is his specialty. He covers both ferrous and nonferrous welding, emphasizing the weldability of high-tensile steels as well as low-alloy steels. In the nonferrous area he is working on the weldability of aluminum alloys and the stainless steels. During our discussion he enumerated some of the problems that are being dealt with currently. These include problems concerning pressure welding of bimetals and slag and flux in arc welding, where there is a question of the ease of cleaning or lifting the slag from

the welded surface. Another problem concerns spray welding. Here alloying elements are burned in the process of spraying, causing composition changes which can be very critical for certain alloys, of course. Anik also is interested in problems of heat transfer during arc welding and spot welding, where control of cooling rates and gradients is so important. Turning to other matters, I discovered that Anik has excellent connections in industry, and considers it a primary duty to collaborate with various companies in order to help solve their problems and in this fashion upgrade the general tenor of welding in Turkey. Quality control in industry is very limited; in general, when a problem arises, industry will come to the University for assistance. To meet these industrial needs Anik and his colleagues have devised special courses for engineers already in industry.

Prof. E. Aladag, who had obtained his PhD at Case Institute of Technology and worked in the area of high pressure both at Case and as a post-doc at Yale, is now turning to powder metallurgy and problems in solidification and casting. However, he is quite busy helping with planning the new research institute so that not very much is being done until he gets into the facility. Aladag very graciously stepped in to act as my guide, since a special meeting of the Science and Technical Council required Gücer's presence.

In summary, after touring the facilities of the Mechanical Engineering Facility, it is quite evident that the new institute is needed and will certainly serve to upgrade materials research, particularly applied research, in Turkey. It must be admitted that although many areas are covered currently, the equipment is quite old, and the techniques are in many cases antiquated. However, Gücer is very methodically assembling an outstanding group of young men who will be able to guide the country's program in directions of ultimate use for its industry and economy.

In the afternoon I was taken to the building which houses the Mining Faculty. That building had been an old military structure with wide corridors, very high ceilings, and a pleasant center courtyard. In the basement, a large auditorium has been installed, and although it was closed, I was told that it was attractive and equipped with excellent facilities. The Mining Faculty is one of nine faculties within the Technical University, and within the Mining Faculty there are five branches - Mining, Metallurgy, Petroleum, Geology, and Geophysics. Each of these branches seems to have two professorial chairs. I had the opportunity to meet with Profs. Veli Aypekin and A. Saroglu; the latter is Professor of Physical Metallurgy, and the former is Professor of Applied Metallurgy. From them I learned that up to a few years ago, the University program was essentially based on the educational system of German engineering schools; i.e., five years produced a degree comparable to a Master's of Science degree. But now, the Technical University program is in a transition period which will lead to an American-like four-year program with the BS as the first degree, followed by an MS. A research project is required for both degrees as well as a 22-week summer training program usually in industry. Presently, there are 300 students in Metallurgy. About 60 students per year are admitted, but this will be reduced to 40 per year. Of these students, 5 to 10% come from Mid-Eastern countries and the rest from Turkey itself. In past years the University has been assisted greatly by the AID Program in building up its educational program, and, has had an affiliation with the Colorado School of Mines. As a general principle, some of the staff is always abroad, and in particular this year there are members of the staff in the US, UK, Canada and Germany.

The research topics chosen for theses range through the following kinds of subjects as examples: effects of impurity on locally produced ductile iron; fluid-solid reactions in copper pyrite; fatigue of commercial aluminum alloys, ore dressing, yield point relations in mild steel, evaluation of Turkish bentonites. Among the interesting research projects, one concerns determination of the equilibrium diagram in the solid range at room temperature for the oxides of aluminum, magnesium and silicon. Part of this work will include structure determinations by x-ray technique. Since Turkey has both iron and copper ores, it is natural to find considerable emphasis on the extractive metallurgy of both. As part of the work in foundry research,

there is included a program on the study of sands for molding practices.

During my tour I had an opportunity to visit a number of the laboratories, including the mechanical testing laboratory, hydro-metallurgy laboratory, and extractive metallurgy laboratory. I found a wide variety of equipment; a good deal, however, was quite old and not mechanized. There were small shops available in which equipment is built, and I was impressed by several pieces that have been home produced. Since so much of the equipment is brought from abroad, it has become necessary to develop special skills to repair foreign equipment, and this seems to have been done successfully. Non destructive testing gives indication of becoming an important activity; in these laboratories appropriate test equipment include a portable radiographic unit, cobalt-60 source, and ultrasonic devices. Metallography seems to be in very good shape with several metallographs of more recent vintage, plus a large number of desk microscopes.

A final note: in view of a current boom in the Turkish metals and mining industry, all graduates find jobs quite easily. (E.I. Salkovitz)

MATHEMATICAL SCIENCES

TIME SHARING - IS IT WORTH IT?

In an article in New Scientist, 3 February 1972, John N. Buxton, Professor of Computing Science at the University of Warwick, gave his views on time-sharing. In the following are some of his opinions.

"Communications-based systems give the user three things: centralised information, rapid access to that information, and computing power at the center where the information is. Such systems are expensive."

Buxton claims that for airline reservations, on-line operation is worthwhile in strict financial terms. He said that in business, there is a lot of information, such as for payroll and stock control, that does not change more than once a week, even once a month, so to use a time-sharing service bureau for data processing of this sort is "essentially ridiculous."

He had this to say about Government operations - "Government is probably the industry where information is of least value and moves the slowest; the concept of centralised information stores for the Inland Revenue fills me with amazement."

On getting the data into a time-sharing service, Buxton claimed that "In batch mode there can be a several hour delay in getting your answers back, and if you use time sharing it can cost a small fortune." As for alternatives to the above-mentioned modes of operation, he advocated the boy on a bicycle. The advantages of such an access system are: low maintenance, small capital investment, and an endless supply of boys.

On storing the information, "it is disastrously expensive to put it on magnetic drum or a big revolving disc - which are just about the most ludicrous devices for storing information that can possibly be conceived, but which are invariably used in big time-sharing systems." He goes on to say, "If you look at one of these discs revolving, it's apparent that each particular section passes beneath the read heads many millions of times without ever being looked at -- the inefficiencies are absolutely overwhelming. Contrast this with a library - a typical large information store. Unlike the principles of the revolving disc, the library does not have dozens of librarians throwing up books into the air with one hand and catching them with the other. You must ask yourself the question: What is your information really worth, and what is it worth to make it dynamic? It is usually worth much less than most think, and not much more if made dynamic anyway."

Finally, Buxton ends the article with -- "Not many time-sharing applications are really worth the money. I would guess that three-quarters could be replaced by something cheaper. Indeed, I do not believe that half of the computers in use are really worth having at all."

It should be noted that John Buxton is one of the leading software experts in Europe, specializing in systems programming languages. He is the co-editor of the widely circulated NATO Science Committee Report "Software Engineering Techniques", Rome, Italy, 1969. (Franklin F. Kuo)

OCEAN SCIENCES

PROGRESS WEST OF GALWAY

Although a return visit to the University College, Galway, Eire, has not been possible in the last several years, conversations, correspondence and publications such as "Marine Science and Technology in Ireland - A Review" would suggest that the peaceful hamlet of Carna is about to be engulfed in present and future developments of the marine facilities there. At the time of my 1967 visit with Padraig O'Ceidigh, Professor of Zoology at the University College, Galway, the marine facilities of the University at Carna were contained in a 40' x 60' moss-covered, stone building which could easily have served as the inspiration for a ballad. At that time the 45-foot motor Launch, UNA WAN, had just been acquired for research and teaching purposes but had not been refitted or brought around to the Carna dock. Since then there would appear to have been a number of major accomplishments, including plans and funding for the construction of a new "Shellfish Laboratory,"preliminary planning for the development of an "International Marine Biological Laboratory," the acquisition of at least two additional vessels plus equipment and supporting facilities, and the establishment of a Chair of Oceanography coupled with the expansion of student interest and research projects.

Through support from Westsea Ltd., a local shellfish industry, and a grant from the Central Development Committee of the Department of Finance, construction of a single-story, approximately 6,000 ft^2 "Shellfish Research Laboratory" was begun during the fall of 1971. The research wing, approximately half of the building, has a central mass-culture room, flanked by two hatchery laboratories and a room for running sea water. The remaining portion of this wing is taken up with four research laboratories and a balance room. The administration-maintenance wing of the Laboratory houses the library, storeroom, prep room, workshop, darkroom, furnace room, Director's office, and the traditional "common room." All laboratories are provided with running sea water, and the hatchery laboratories have temperature-controlled seawater which is first filtered and run through uv sterilizers. Supporting personnel for the Laboratory are already funded and include three scientific officers, two technicians, two boatmen, and one postgraduate student.

In addition to the 48-ft UNA WAN a 70-ft tug, CORRUNA, powered by twin 150-hp engines has been obtained recently for expanded studies in the Galway Bay area. A number of items of basic oceanographic equipment have been acquired, including bathythermographs, continuous surface temperature recorders, salinometers, grabs, trawls, underwater TV, and radar and sonar have been added to the UNA WAN. A Havas underwater scooter rounds out the fleet and is supported by equipment for underwater work including aqualungs, compressors, underwater camera, etc.

In 1970, Bryan Bary, formerly with the Department of Oceanography at the University of British Columbia, was appointed to the newly established Chair of Oceanography at Galway. It would appear that his interest, coupled with that of O'Ceidigh, has led to a considerable enlargement in the number of graduate students working in the general realm of "marine sciences." His appointment has also led to a consideration of an oceanographic program, including the need to acquire a 170-ft oceanographic research vessel for deep-water work plus a 70-ft vessel for research on the continental shelf.

In what would appear to be a joint effort, tentative plans for an "International Biological Laboratory" have been developed on paper which would be located adjacent to the existing facilities at Carna. The projected laboratory would accommodate 50 undergraduates, 15 postgraduate and postdoctoral workers, and a resident staff of at least 10 scientists. In addition to teaching facilities, including a lecture hall, library, and teaching laboratory, the plans call for living accommodations for the students and resident staff. It is estimated that the total capital cost would be approximately £450,000, not including the oceanographic vessels. Recognizing that the University College of Galway may not be able to meet these costs, efforts are under way to obtain some financial support from outside sources and then convince the University that it should meet the recurring annual expenditures. Presumably with an eye toward government support and "public relations," reference is made to the possibilities of develop-

ing a "Dolphinarium," which one assumes is an aquarium with exhibits, as well as a shark pen and viewing stand which would permit sub-surface viewing.

In the meantime, all indications suggest that the original group of O'Ceidigh, plus those added with the expansion and addition of the Chair of Oceanography, continues to proceed with their research interests. The plankton studies, initiated by O'Ceidigh in 1958 but largely unpublished, deal with seasonal variations in coastal plankton samples from a large number of stations within the sea area to the west of Galway Bay. These studies have largely involved copepods, decapod larvae, fish larvae, chaetognaths, tenophora, and medusae. Work on the copepods, fish larvae, and chaetognaths has already been published, and perhaps we can still look forward to the publication of the decapod larva work before too many more years. B. Keegan and an additional six people are continuing the benthic studies which now include an interest in bottom communities and their seasonal fluctuations. A relatively new littoral program is presently confined to a relatively small area of the beach and is concerned largely with zonation studies on different shore types.

Within the shellfish program a number of commercially important species are being considered. This includes studies on the general biology of Panulirus, making special use of scuba and underwater TV techniques; the distribution, growth and reproduction of the clam, Venus, with additional studies on growth of Mercenaria introduced from the United States. One MSc candidate is working on the biology of Palaemon, while several others are working on Mytilus, Osterea, Nephrops, and Cancer. On the Galway campus a new laboratory and supporting equipment have been developed for electrophoretic studies on fish hemoglobin.

Conversations with O'Ceidigh at the 6th European Symposium of Marine Biology, Rovinj, Yugoslavia, would suggest that while he is pleased with the progress to date, he is quite concerned about the ability to obtain additional support for the oceanographic program and the proposed international marine laboratory. When one considers the cost of construction of oceanographic vessels, even in foreign shipyards, and the day-to-day expenses of running a 170-ft oceanographic vessel, it is natural to wonder just where such support might be available in Southern Ireland. However, from the progress over the past five years one should not underrate the persuasive power of O'Ceidigh and the outside chance that he has certain connections with the leprechauns for which his area of the world is so famous. (J.D. Costlow)

PHYSICAL SCIENCES

COLLOIDAL PHYSICAL CHEMISTRY AT MONTPELLIER - A USEFUL BIOMEMBRANE MODEL?

I began my trip to Montpellier, partly described earlier (ESN 26-2), with a visit to the Departement de Physico Chimie Colloidale which shares a rambling new building with the Departement de Biochimie Macromoleculaire (DBM). Unlike the DBM, however, this Department of approximately 35 scientists and technicians is organized along the usual European lines with Dr. J. Guastalla as its head. Guastalla is a warm, pleasant person of about 60 with a beard, suntan and informal clothing, rather reminiscent of Hemmingway in his later years. Unlike most French upper-echelon scientists I have met, Guastalla's English is rather shaky - but, during our first few minutes together we discovered my French was worse so we spoke mostly in English! Despite the fact that his laboratory is organized on a conventional European basis, Guastalla is very sympathetic to the DBM efforts at reform. In fact, according to Dr. Ohlenbusch at DBM, he played a key role in prying building funds loose from the Centre National de Recherche Scientifique.

Guastalla told me his general interests are in the electrical properties of interfaces between immiscible phases in the presence of surface active agents, but in practice, the work in his laboratory touches on more than their electrical properties. For example, during a guided tour, I spoke to three people in a physics group who are using ellipsometric methods to study the surface layers of various surface active molecules. They have just finished building an automatic ellipsometer (with a rotating quarter wave plate for modulation) and are in the process of trying to confirm some earlier measurements made with a simpler instrument. (They seemed, however, to

be unwilling to tell me what systems they were studying or what they were trying to learn about them. I never did decide whether they had some specially significant results or were covering up a lack of results - but they were very friendly about it all!)

Another person I met in Guastalla's group was a woman who is studying the lipid content of Staphylococcus mutants and trying to correlate this with their sensitivity to various surface active bacteriocidal agents. The mutants, which were screened by their resistance to these bacteriocides, contained about 5% lipids or twice the lipid content of normal Staph cells, and this may play some role in protecting them. She has also done microscopic electrophoretic studies on individual bacteria and has concluded that bacteriocides such as alkylammonium halides were inside the cells and not on the surface as one might expect.

Over a period of years Guastalla has had a strong interest in surface tension measurements, and he has developed several new instruments for measuring this property. Two of these are described, for example, in English in the Proc. of the 2nd International Congress of Surface Activity (Butterworth, 1957), and there are a number of such instruments in use in the laboratory. One of these instruments is unusual in that it is capable of measuring the surface tension between a liquid and solid and, apparently as an outgrowth of his ability to make such measurements, Guastalla developed a new theory of solid-liquid surface tension which he feels is a great improvement over classical theories. His disappointment that so little attention seems to have been paid to these advances was clear, so I would especially call them to the attention of any readers with an interest in the subject. The theory is described in the Butterworth publication just cited, and Guastalla has also published a more complete description in French which he is presently having translated into English.

As I mentioned earlier Guastalla's current personal interests are centered on the electrical properties of interfaces, and recently he has been doing some curious work in this area which he thinks may be relevant for our understanding of biological membranes. A typical experiment would be done as follows. An aqueous solution, 0.001 M in potassium chloride and saturated with potassium picrate, is layered on a 0.003 M solution of tetradecyl trimethyl ammonium picrate (R^+Pi^-) in nitrobenzene. Since the water and nitrobenzene are mutually immiscible, a stable interface will develop between them. At this interface there will be an excess of the long-chain picrate since in this location it can lower its energy by having its polar portions in the water and nonpolar portions in the nitrobenzene. A voltage is now applied across the interface with the polarity such that a small amount of R^+ is attracted into the aqueous phase. Since, to a first approximation, no chloride can simultaneously be drawn into the nitrobenzene, a considerable voltage gradient may appear across the interface itself, i.e., over a thickness of perhaps 100 Å. At this point the interface is crudely analogous to a polarized biological membrane.

Guastalla has studied a number of electrical properties of such interfaces, especially their voltage-current characteristics. One of his most surprising findings is that there is a marked hysteresis in these characteristics even when the applied voltage is charging as slowly as 14 mV/min. The origin of the slow changes that cause this hysteresis are not clear to Guastalla, although it would seem a reasonable guess that there is a slow step involved in the formation and breakup of the detergent micelles. To date, Guastalla's only publication in English on the subject is in Nature 227, 485 (1970). Much of his more recent work is summarized in a French manuscript he gave to me of a talk he presented at a meeting in Strasbourg in November.

In summary, I would say that Guastalla's laboratory impressed me as one very well equipped for doing classical physical chemistry of colloidal systems (in very pleasant surroundings!). (J.G. Foss)

MULLARD AT REDHILL

Mullard Research Laboratories is one of about six research laboratories in the Philips complex. Other labs are located in the Netherlands, Germany, France and Belgium. Mullard Labs has about 600 employees, 200 of whom have graduate equivalents. The Labs are

located a half hour by train south of London in Redhill, Surrey.

The Director of the Laboratories at Redhill is Prof. K. Hoselitz, and he has five divisions reporting to him. One is an engineering support division and will not be discussed here. The names of the remaining four are: Solid State Physics, Vacuum Physics, Circuit Physics and Applications, and Systems with respective Division Heads, Dr. J.C. Walling, MBE; Dr. P. Schagen, OBE; L.G. Cripps; and N.E. Goddard. Within each Division there are a number of groups and group leaders roughly organized according to the objects of research, but there appears to be considerable interchange among groups and divisions.

In the Solid State Physics Division there are groups on silicon integrated circuits, materials, semiconductor physics, magnetism and ferroelectrics. Part of the interests of the magnetism and ferroelectrics group, headed by Dr. R.F. Pearson, is magnetic materials and techniques for optically recording information at high packing density, fast access, and in an erasible-reusable manner. The group is interested, actually, in all reusable media for optical recording. It has looked at KTN (potassium tantalo niobate) and reported results of the longitudinal quadratic electro-optic effect in KTN in Electronics Letters 7, 139 (25 March 1971). The same group also developed a Ho^{3+} : YAG laser transfer-assisted with Er^{3+} and Tm^{3+}, emitting at 2.1 μm, tungsten-cw-pumped, Q-switched up to 200 Hz, multimode average output power up to 18 W, pump efficiency about 1.45% (multimode), and liquid nitrogen cooled. (cf. Johnson, Gensic, and Van Uitert, Appl. Phys. Ltrs. 8, 200 (1966) for first US work). The laser rods were grown by the materials group at Mullard. The intention was that the laser might be useful for eye-safe machining and welding, but no demand has as yet developed within the laboratories for it.

The Vacuum Physics Division has groups on beam technology (electron and ion beams), light detection, gas discharges, and imaging devices. Negative electron affinity III-Vs are being researched (the first publication on the effect was by the Philips lab in the Netherlands), but no detailed information was obtained other than the materials had not yet been developed to the point of tube manufacture. Mullard is heavily engaged in Channel Electron multipliers similar to the work of Bendix (and others) in the States, and has developed a number of devices using them. Good reviews of the subject are given in Acta Electronica 14, No. 1 (Jan.1971) and 14, No. 2 (April 1971) with articles by Dr. Schagen in No. 1 and by Pook, Millar, Pettey, two Timothy's, Woodhead, Beasley, and Adams in No. 2, all of Mullard. These two volumes of Acta Electronica and one to come out soon are highly recommended to those interested in the subject. Schagen has written a review on electronic aids to night vision, Philosophical Transactions of the Royal Society of London, A269, No. 1196, p. 233-263 (5 Feb 1971) which is also highly recommended. The work on gas discharges is mainly concerned with light-emitting, gas-discharge panels. Mullard feels that its panels have advantages over those of others by virtue of design which is claimed to eliminate sputtering problems while maintaining high brightness. A 5 x 7 element array has been developed with a lifetime in excess of 10^4 hours. The ballast resistors are in the power supply rather than integrated with the panel. The elements are about 1 mm in diameter. The gas fill is neon, argon, and mercury to a total pressure of 30 cm Hg. Mullard thinks that for panels up to 200 x 200 the ballast resistors can be handled in the power supply. The electron and ion-beam work, a separate group, within the Division, is mainly concerned with techniques; the ion-implantation research, for instance, is carried out elsewhere; the Vacuum Physics Division develops only the experimental equipment.

The Circuit Physics and Applications Division has groups working on computer techniques, linear circuits, ferrite devices, computer applications, and automotive braking. The last group has about finished its work which was to develop an electronic anti-locking brake system which could be used independently on all wheels of an automobile. Mullard feels this work has been quite successful and is negotiating with other companies for its adoption. Another group within the Division is developing the software for computer graphics for use in the laboratory multi-terminal ICL computer system. Also, it is working on written character recognition systems.

The fourth technical division is called "Systems" and incorporates groups working on microwave techniques, electronics, microwave systems, gas chroma-

tograph systems and communications. This Division is taking the lead, but has help from other Divisions, in the application of acoustic-surface-wave filters. The major project is to develop filters for TV sets, each filter to sell at somewhere around 20 NP (about 50¢). The design, arrived at with computer programs, 's close to final, and the problem remaining is to iron out the substrate production. The filter design is considered to be more compact than Zenith's, and it may be the case that both Mullard and Zenith are using the same or quite similar ceramics, but no information on what ceramics look best is presently releasable. When questioned about what future programs Mullard might undertake in the acoustic-surface-wave area, the Mullard researcher thought that work beyond the TV filter would be unlikely since the market projection for other applications is too thin. One exception might be if non-linear correlators were shown to have much improved dynamic ranges than now realized.

In a short visit it was not possible to explore a number of the areas of research mentioned. However, general impressions can be gained. One question which was discussed is the overall operation of Mullard Research Laboratory. Its funding comes out of gross sales, not profits, to the tune of 80%. Ten percent more comes from Government contracts, and the remaining ten percent comes from producing Divisions of Philips which require research support. The division of research efforts among the various laboratories in the Philips complex is worked out through panels comprised of representatives from the various laboratories, and extremely good communications, both through periodic progress reports and personal contacts, seem to exist. The coordination among the laboratories is more in the horizontal than vertical mode and is reported to be both adequate and amiable. (W.J. Condell)

MISCELLANEOUS

JAPAN: AN ACKNOWLEDGEMENT

My report on the recent "First International Symposium of the Japan Welding Society" has appeared in ESN-26-2, and I have also been reporting on other aspects of my visit to Japan. Although not strictly technical, it might be of interest to report on a speech made at the conference banquet.

The occasion was quite formal and perhaps somewhat stiff, as these events are oft wont to be in Japan. The approximately 200 guests were treated to an excellent western-style meal with a selection of surprisingly good Japanese wines and after-dinner cognac. I found that it is usual to employ Western-style catering at large gatherings, as Japanese-style leads to complications and delays in the actual serving and clearing. In deference to the foreign guests, a few Japanese delegates actually had either their wives or their daughters with them, but this is not the usual thing in this country.

There were a number of speeches given before, during, and after the dinner, according to the best Western tradition. My Japanese colleagues had forewarned me that such affairs tend to be stiff, and that a Japanese tends to be even stiffer when he gives a speech, even in his own language. And indeed, there was none of the happy informality that we see at similar American or European occasions. At least, not until the very end when food and drink had had an appropriate effect.

I had been asked to deliver the thank-you speech on behalf of the foreign delegates; the President of the Society, Prof. Toshie Okumura, had written to me some weeks earlier so that I was amply forewarned. Nevertheless, it was not a simple task, as I knew that the telling of a joke was not de rigueur, and my favorite ploy of the double-entendre wouldn't work because of language difficulties. Obviously, I had to "tell it like it is" -- it wasn't sufficient to discuss the conference -- I had to go a little deeper. As it happened, a Russian delegation turned up at the conference unexpectedly at the last minute, and the organizers decided to give them equal time. The Russian leader, however, kept quite strictly to welding and the welding society in his speech.

My speech follows -- it represents sincerely what I feel about Japan, and may add a little background to my reports:

"None of us, who come from the Western world, and no matter from what part of it, can fail to be impressed by the incredible achievements of modern Japan. To us outsiders, it seems to have taken place on an exponential scale -- a century or so ago saw the stirrings of a sleeping giant --

a few decades ago, the beginnings of a new industrial age. Today, no one can deny that Japan is at the very top of the industrial scale. There are those who maintain that Japan will be the greatest and the richest nation in the world by the end of this century. You are now the third richest country in the world with your Gross National Product -- already you have equalled Britain with your per capita income. This is an extremely impressive achievement!

"How did all this take place? Some years ago it was felt outside of Japan, that the Japanese workers were exploited, that they were slaves -- how could we possibly compete with such low-paid workers? Today, we know differently! The reason we have trouble competing with you is the fact that your workers and all your people are the most dedicated persons on the face of this earth!

"This is my third visit to Japan in the last few years, and like most visitors, I am always impressed both with your technical achievements and your friendliness, but also with the increasing quality of your life.

"Gentlemen, I was told that many years ago you had an inferiority complex. If that was ever the case, certainly there is no reason for it anymore. You have arrived at the top. But, when you are at the top, then you will have infinitely more responsibilities -- as I am sure you realize.

"To be at the top, you will have to expect a lot of visitors from all over the world to see how you do things. Traditionally for the last few decades, and even longer, it has been the Japanese who have traveled everywhere -- in fact, I saw Prof. Okumura inspecting a welded bridge in Czechoslovakia just a few weeks ago! Now, today, you will have to get used to having a lot of foreign visitors coming here -- all with their cameras -- and if they are like me, the camera will be MADE IN JAPAN.

"This conference, in many ways, marks the coming of age of the Japan Welding Society -- to hold an international symposium and to have such an excellent attendance from all over the world, is indeed a mark of the esteem in which you are held. We, the foreign visitors, are the guests in your country, and yet you are willing to speak a foreign language with us! You have made us feel very comfortable indeed. I assure you that we appreciate it very much.

"We are impressed by you and your country -- and this is true also for this Symposium -- its organization has been superb, we have learned a lot technically, and we have made a lot of new friends.

"Ladies and Gentlemen -- our Japanese colleagues -- on behalf of the foreign guests, I want to thank you heartily for the wonderful hospitality you have shown us -- I want to acknowledge your excellence and accomplishments in the field of welding -- and I want to wish you and the Japan Welding Society every success for the future." (L. Tall)

NEWS & NOTES

NINTH GERMAN AVIATION SHOW

The Ninth German Aviation Show sponsored by the Bundesverband der Deutschen Luft und Raumfahrtindustrie e.V. (BDLI which is the Federal Association of the German Aerospace Industry) will be held from 21 April through 1 May 1972 at the Hannover Airport.

total area of 150,000 m^2 will be devoted to the display of the most advanced technological developments presented by all of the world's leading firms in the aerospace field.

Exhibits will range from complete systems for air and space travel to the many varied parts and elements essential to the operation of any system.

The German Aviation Show will be held simultaneously with the Hannover Fair (20 April through 29 April 1972). The visitor will thus have the opportunity of visiting both events to acquaint himself with the latest developments in a wide range of supplier industries.

Further information regarding the Aviation Show can be obtained by writer either the sponsor:

BDLI
53 Bonn-Bad Godesberg
Heerstrasse 90
Phone: 02220/65941-45
Telex: 0885/528

or the organizer:

Deutsche Messe und Ausstellungs-AG
3 Hannover-Messege-lände
Phone: 0511/891
Telex: Hannover: 0922728

(A.A. Ranger)

23rd CONGRESS OF THE INTERNATIONAL ASTRONAUTICAL FEDERATION

An official announcement of the 23rd Congress of the International Astronautical Federation has been received. "Space for World Development" will be the keynote of the IAF Congress to be held this year in Vienna, Austria, 8-15 October 1972.

The program of the 23rd Congress will be built around this theme and will include open discussions of relevant topics, as well as sessions of a more technical nature appealing to specialists. The site of the 23rd Congress will be the Vienna Congress Center. The host society is the Osterreichische Gesellschaft für Weltraumforschung und Flugkorpertechnik (OGFT).

It is not yet known whether the Proceedings will be published. Information on this question will be issued at a later date. (A.A. Ranger)

POLLUTION PROFITS

An item from "News of Norway" states, "Pure spring water is being exported by an increasing number of Norwegian companies including Bergensmeieriet (The Bergen Dairy), Bergen. This company owns the North Rogaland dairy at Sandied which has now stopped producing milk and started bottling water instead. This year the firm hopes to export 10 million liters of spring water, having already shipped 32 tons to Belgium and the Federal Republic of Germany." (J.G. Foss)

PERSONAL

Dr. Norman Percy Allen, CB, FRS, formerly Superintendent of the Metallurgy Division, National Physical Laboratory, died on 23 February. Allen, who retired in 1968, was one of Britain's outstanding metallurgists, having directed many of the important advances in alloy design and in utilization of new metals at NPL.

Prof. A.S.V. Burgen, formerly Head of the Department of Pharmacology at the University of Cambridge has succeeded Sir Peter Medawar as Director of the National Institute for Medical Research, Mill Hill, London.

Prof. C.A. Coulson, Univ. of Oxford, has been made president of the Institute of Mathematics and its Applications. The new vice-president is Prof. Heini Halberstam, Univ. of Nottingham

Dr. Roy Ellis, St. Bartholomew's Hospital Medical College, London, has been appointed professor and head of the Department of Medical Physics, University of Leeds, from Oct. 1972.

Prof. M. Freedman, Univ. of Oxford, Prof. A.T. Peacock, Univ. of York, and Prof. B.E. Supple, Univ. of Sussex have been appointed members of the Social Science Research Council.

Dr. S.J. Goldsack has been appointed to the new Control Data Chair of Computing Science in the Department of Computing and Control, Imperial College, Univ. of London.

At Bradford Univ. Dr. I. Goodman, Senior Scientist with ICI Ltd., has been appointed to the Chair of Polymeric Materials, and Prof. P.B. Mellor, of the Dept. of Mechanical Engineering, Birmingham Univ., has been appointed to the Chair of Mechanical Engineering.

Dr. L.E. Glynn, Deputy Director of the MRC Rheumatism Research Unit, has been appointed director of the Mathilda and Terence Kennedy Institute of Rheumatology.

At the Univ. of Lancaster H.S.L. Harris, Cambridge Univ., has been appointed to the Chair of Engineering; and Dr. Philip M. Levy, Dept. of Psychology, Univ. of Birmingham, has been appointed to the Chair of Psychology.

Sir Alastair Pilkington has been appointed to the Science Research Council in succession to Mr. D.L. Nicolson.

Prof. Kenneth Simkiss, Queen Mary College, London, has been appointed professor of zoology in the University of Reading.

Surgeon Rear Admiral James Watt, RN, has been appointed to succeed Surgeon Vice Admiral Sir Eric Bradbury, RN, as Medical Director General (Naval), in July 1972.

ONRL REPORTS

The following reports have recently been issued by ONRL. Copies may be obtained by Defense Dept. and other US Government personnel, ONR contractors, and other American scientists who have a legitimate interest. Requests for ONRL reports should be addressed to: Commanding Officer, Office of Naval Research Branch Office Box 39, Fleet Post Office, New York 09510, or the Defense Documentation Center, Cameron Station, Alexandria, Virginia 22314.

R-3-72 Activities in Marine Science at the Swedish Board for Technical Development (STU) by K.E. Slayman

R-4-72 New Bath University of Technology by A.A. Ranger

R-5-72 New Shock Tube Laboratory at Aachen, Germany by A.A. Ranger

C-[illegible]-72 UMIST, The Solid State Physics Conference by W.J. Condell

C-5-72 Symposium on the Effects of Pressure on Organisms by R.R. Sonnenschein